JUL 18 1910

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second-class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the Act of Congress March 3, 1879

VOL. XXV NO. 2 | SAN FRANCISCO, JULY 9, 1910 | PER COPY, 10 CENTS

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JOURNAL OF ELECTRICITY
POWER AND GAS
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VOLUME XXV SAN FRANCISCO, JULY 9, 1910. NUMBER 2

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STOCKTON GAS AND ELECTRIC COMPANY'S NEW SWITCHBOARD

BY L. A. SOMERS.

Among other improvements instituted by the Stockton Gas & Electric Company, of Stockton, Cal., during the past twelve months, may be mentioned the installation of one of the most modern and up-to-date switchboards, that has yet been furnished for central station practice on the Pacific Coast.

Fig. 1. General View Interior of Stockton Gas and Electric Co.'s Station, Showing Switchboard.

This board is arranged for the control of both alternating current and direct current circuits, and was designed by W. F. Lamme, consulting engineer of the San Francisco office of the Westinghouse Electric & Manufacturing Company, to meet the requirements of the Stockton Gas & Electric Company.

This switchboard is of the double bus bar type and all high tension switches are of the remote control type. As a result, the highest voltage that an operator can come in contact with on the switchboard itself on the alternating current panels is 110 volts.

If it should become necessary to examine or repair a high tension switch, this can be done quite easily and without any danger whatsoever to the attendant, as the board is built on the double bus bar plan and every oil switch is in duplicate.

These high tension oil switches are mounted over-head, directly above the switchboard. As stated above, the high tension switches are in duplicate. In front of each set of switches is arranged an iron gallery. When one set of switches is opened for inspection or repairs, it is absolutely impossible for the

switchboard attendant to come in contact with the other set of live switches.

This feature was introduced on the suggestion of Victor Etienne, formerly managing director of the Stockton Gas & Electric Company, and much credit is due the management of this company in requiring that the board be made as safe as possible, to the end that no loss of life or accidents might occur to the operator.

A rather novel feature may be mentioned in connection with the method of installing the graphic recording wattmeters, shown on Panel No. 8. These instruments are so arranged that by means of a special auxiliary bus-bar system, they can be plugged in for testing on any circuit on the alternating current side of the switchboard.

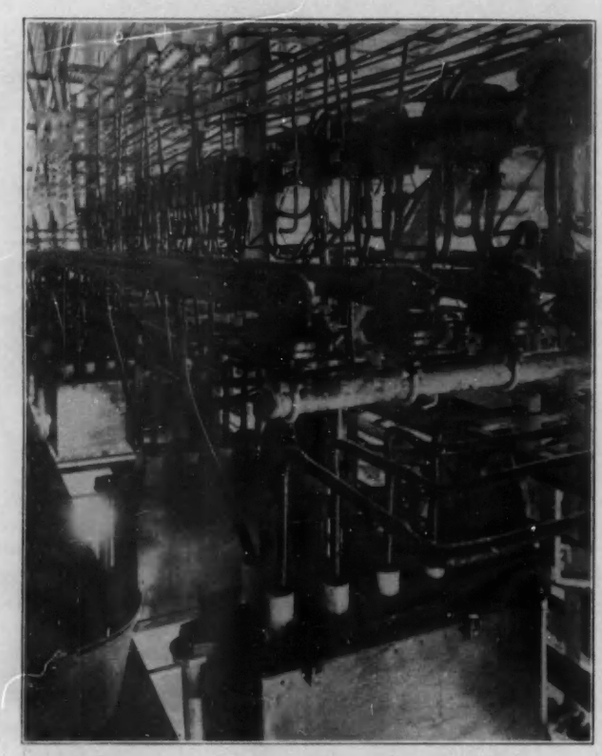


Fig 2. Overhead Gallery Showing Roomy Arrangement of Circuits. Series Transformers and Bus Bars.

A new conception in the equipment of central stations may be noted by referring to Fig. 1, where two handsome palms are shown directly in front of the switchboard. This idea is due to the artistic taste of Henry Adams, general manager of the Stockton Gas & Electric Company, who has supplied these beautiful plants as well as a number of ferns and hanging baskets, which may also be seen in the photograph. The board was erected by the employees of the Stockton Gas & Electric Company, and the marble, framework and the over-head iron work were also furnished by that company.

A detailed description of the board, panel by panel, is as follows:

Panel No. 1 controls the 400kw. Westinghouse motor generator set, shown in the foreground in Fig. 1.

Panels No. 2, No. 3 and No. 4, are the direct current panels, controlling the direct current circuits which supply the railway service of the Stockton Electric Railroad Company. These panels are equipped with Westinghouse type "E" illuminated dial voltmeters and ammeters.

Panel No. 5, is a blank panel for future extension.

Panel No. 6 controls the incoming circuit from the American River Electric Company's lines.

Panel No. 7, controls the incoming circuit from The Pacific Gas & Electric Company's transmission line.

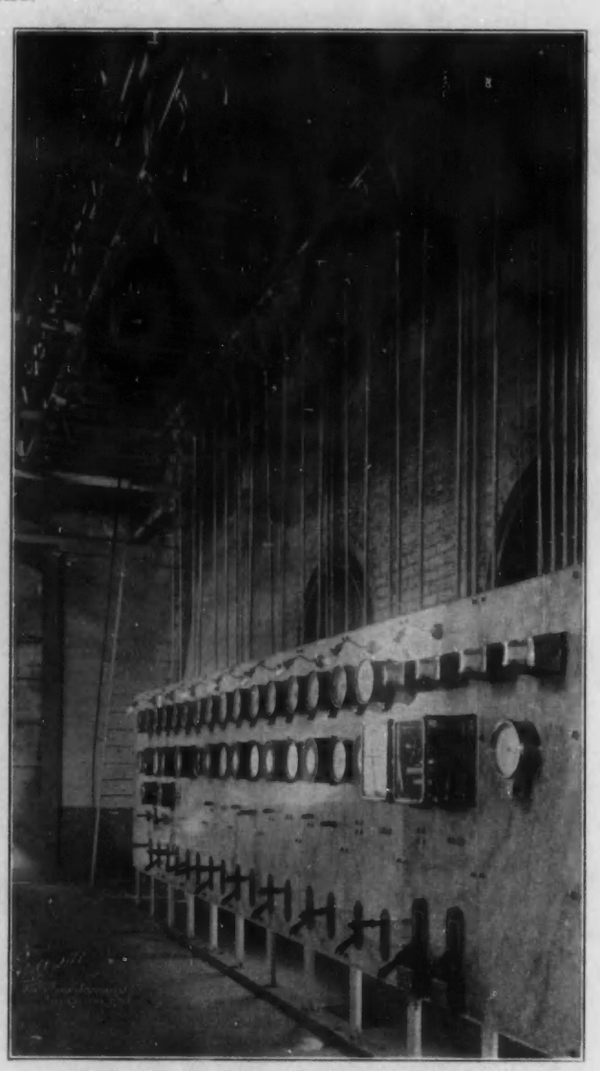


Fig. 3. Control Rods and Levers Giving Remote Mechanical Control.

Panel No. 8 is known as the main bus-bar panel, and has mounted on it, two Westinghouse Graphic Recording Wattmeters; two type "B" four pole, single throw oil switches; two type "F" voltmeters.

Panel No. 9, controls the three phase feeder panel, which serves as a power feeder for all three phase power furnished by this company.

Panel No. 10 is a two phase power feeder panel has mounted thereon the following instruments:

2 four pole, single throw type "F" circuit breakers.
2 type "F" ammeters.
1 type "F" polyphase indicating wattmeter.
1 type "C" polyphase integrating wattmeter.
1 lamp bracket.

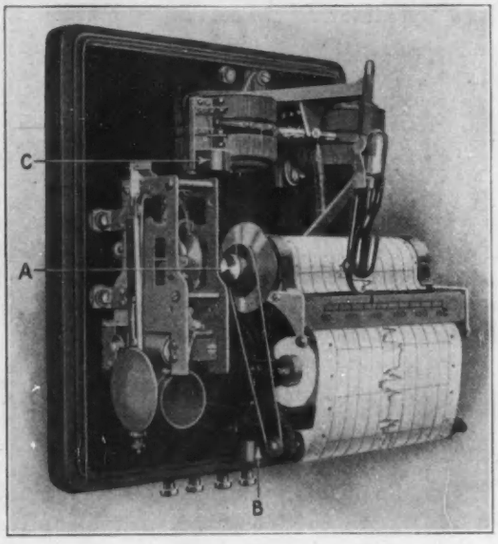
Panel No. 11 is also a two-phase power feeder panel, and has mounted thereon the following instruments:

2 four pole, single throw type "F" circuit breakers.
2 type "F" ammeters.
1 type "F" polyphase indicating wattmeter.
1 type "C" polyphase integrating wattmeter.
1 lamp bracket.

Panel No. 12 is a two-phase lighting feeder panel, and has mounted thereon:

2 four pole, single throw type "F" circuit breakers.
2 type "F" ammeters.
1 type "F" polyphase indicating wattmeter.
1 type "C" polyphase integrating wattmeter.

Panel No. 13 is also a two-phase lighting feeder panel, and is equipped with the same number and style of instruments as Panel No. 12.



Graphic Recording Wattmeter.

Panel No. 14 controls the two-phase arc lighting circuit, and has mounted thereon the following instruments:

2 four pole single throw type "D" oil switches, remote control type.
1 type "C" integrating polyphase wattmeter.

Panels No. 15 and No. 16 are for the control of motor generator sets No. 1 and No. 2. Each of these panels has mounted thereon:

2 four-pole, single-throw type "D" oil switches, breakers.
2 type "F" ammeters.
1 type "F" indicating wattmeter.
1 type "C" integrating polyphase wattmeter.
1 lamp bracket.
1 type "E" direct current ammeter.
1 type "D" field switch.

Panel No. 17 is a blank panel for future extension.

The above panels are composed of seventeen marble slabs, of blue Vermont marble, each slab being 72 by 30 by 2 in. and mounted 25 in. from the floor.

When facing the switchboard, the above panels are numbered from one (1) to seventeen (17) reading from right to left.

POSSIBLE IMPROVEMENTS IN STEAM POWER PLANT ECONOMY.

Discussion before the San Francisco Section, American Institute of Electrical Engineers, of paper by L. R. Jorgensen as published in the Journal of Electricity, Power and Gas of June 25, 1910.

Question: Is there any plant in operation where they have that second superheater?

L. R. Jorgensen: The installation of a second superheater in the flues leading to the smokestack has, as far as I know, not been proposed before. The low temperature of the steam (probably about 212 degrees) exhausted from the engine makes possible a transfer of heat from the flue gases to the steam, heat which otherwise would go to waste.

The combination of a reciprocating engine and a low pressure turbines is not a new and a large number of similar installations are in existence. On board a ship this kind of installation should work well, too, and especially where artificial draft is used. A high temperature of the flue gases for creating draft would then be unnecessary. This is an expensive way to get draft anyway. However, with the new Melville Macalpine gear very likely a high speed turbine alone would make the best installation on a ship, and the second superheater should then be connected between the high pressure and low pressure portion of turbine.

S. G. Gassaway: I should think such a superheater would have to have a very large area of pipes.

L. R. Jorgensen: How large the second superheater would be depends upon the difference in temperature between the exhaust steam and the flue gases. If a high boiler pressure is used the temperature of the flue gases will also be high. The superheater could be installed below the floor, and could be made of sheet metal the same as the flue for the reason that this device would not be called upon to stand any pressure. It would be altogether different from an economizer in that respect.

George W. Dickie: Mr. Chairman, I did not come here to talk tonight. I came here to learn something. This matter of the economical use of steam is an important factor in all steam installations. It is unsatisfactory that we can only utilize such a small percentage of the heat that we get from the fuel. We have been told tonight of the difficulty with the turbine, and with the reciprocating engine, and how engineers have been trying to take away the troublesome end, which is at the beginning with the turbine and at the end with the reciprocating engine, from both in order to be able to use the steam most economically.

I was thinking while the paper was being read of a patent that was taken out in 1886 by a man in London named Leonard Jennet Todd, for an engine that he called the central exhaust engine. Very little was done with it because he evidently did not know just what he had really done; but in the last two years or so this engine has been taken up by a German professor, J. Stumpf, and out of it has been evolved what is now called the uni-directional flow engine. It is creating considerable comment in Europe. I saw a notice that one prominent firm was obtaining from it a most remarkable result, a steam consumption of 8.8 pounds of steam per hour, and as the engine is much simpler than either our reciprocating engine or the turbine, I am sure that, if what is claimed for it be true, it will in time take a very prominent place among prime movers.

In the horizontal type of this engine, the live steam is admitted from below into the cover, serves to jacket the latter, and finally enters the cylinder through the valve. At the completion of the working stroke it is exhausted through ports or slots which are provided in the middle of the length of the cylinder and which are uncovered by the piston as it completes its stroke. The direction of the flow of the steam is, therefore, never reversed. In the ordinary engine, on the contrary, the flow of the steam is alternating; that is, steam enters at the head of the cylinder and follows the piston while doing its work and at the end of the stroke the flow is reversed and it has to run back through an

exhaust valve at the point where it entered. This reversal of the steam flow leads to a cooling of the ports of the cylinder by the wet steam and consequently there is an increased condensation in the cylinder during the next cycle. It is claimed that the unidirectional flow avoids this cooling and resulting condensation in the cylinder and does away with the necessity of compounding These engines may, therefore, be designed for one stage doing all the expansion in one cylinder and giving an economy equal to the multiple expansion engine. The exhaust port being the whole circumference of the cylinder and opening directly to the condenser, the pressures in the condenser and the cylinders immediately equalize when the piston uncovers the port; on the return stroke any uncondensed vapor in the cylinder is entrapped and compressed in most cases to near the initial pressure. In the middle the cylinder has a temperature near to that of the condenser while at the ends the temperature is near to that of the entering steam which in these engines is usually superheated and that condition will be constant.

I think there is something worth studying in this especially for possible use here in California where the simplicity of this engine should make it attractive on account of the high cost of local labor. I can hardly believe the economy claimed, but it is certainly worth looking into for you who are so much interested in power plants and their economic working.

A. H. Halloran: To the operating engineer the most interesting part of this paper is the suggested economy of the boiler, or rather the economy in combustion. As the author brought out in his paper, a low pressure steam turbine can be added to a reciprocating engine, and improve its present efficiency. This is a matter for the manufacturer; but the efficiency of combustion is something that can be improved by every fireman. Mr. Jorgensen has shown that from 90 to 95 per cent of the energy in coal is wasted. One-third of this goes up the chimney as smoke. One-half of it is lost in exhaust steam. It seems to me that if our engineers and also legislators devoted as much time to improving the economy of existing power sources as they now expend in attempting to withdraw water-power sites or coal and oil lands, they would do more for our posterity and incidentally for ourselves, because our posterity will blame us far more for our wasteful use of power than they will praise us for our conserving disuse.

This matter of waste in the furnace is usually under-estimated. If the owner of a steam-power plant had to pay for his air as he does for his water he would soon caution his fireman to be careful. As Mr. Jorgensen has shown, using an excess of 200 per cent air means a loss of efficiency of 12.9 per cent greater than when 50 per cent excess air is used, this 50 per cent being recognized as good practice.

There are three ways of determining this excess air. You can use an air meter to measure the volume of air entering, and knowing the theoretical amount of air necessary to burn the coal it is easy to estimate what excess is being used. Or you can use a pyrometer to determine the temperature of the furnace gases as compared with the theoretical, to see if you are using too great an excess of air; but the usual method is this method of flue-gas analysis which Mr. Jorgensen has brought out.

An analysis of flue gas shows it consists of carbon monoxide, carbon dioxide and nitrogen, with some water. Mr. Jorgensen's remarks have been devoted largely to coal; and he makes the statement that the efficiency of burning oil is greater because there is not likely to be such a great air excess; but judging from reports that I have on some of the San Francisco plants there is certainly great room for improvement. Most of them are burning 300 per cent air right along. After this excess has once been determined by an expert, all that is necessary is for the fireman to put in one of those indicating CO_2 instruments mentioned by Mr. Jorgensen, and regulate his dampers in accordance with the readings. By connecting the indicator to the damper it is automatically adjusted as the load increases, for with greater load they need more air and coal. These facts seem simple and elementary; but if they can be brought before the fireman, the one who is responsible for the economy of the plant, the efficiency of every one of our local plants would be increased, as Mr. Jorgensen has shown, fully one-eighth, and this matter, while really of small moment, is worthy of discussion. I believe that the local members of the National Association of Stationary Engineers are somewhat interested. I am surprised there are not more of them here, and it would come before that more logically than before our body. The matter of the steam turbine is of course one that requires the services of a manufacturer's designer, and one that does not come within the province of the ordinary fireman.

A Member: I believe this is a matter that the section could very well afford to take up, inasmuch as any time you look around town from any point of vantage you will see a continual cloud of smoke coming out of almost every chimney. That smoke is not only a waste; it is a detriment to the health of the city, and causes a great deal of damage, and in every way you look at it it is a thing that should be eliminated, because it is quite possible to eliminate it. I believe it would be an advantage if the section were to take some action on the subject to bring it before the city authorities, or to get the other engineering bodies to take some action to see if it cannot be cut down somehow.

L. R. Jorgensen: I would like to say a few words about the CO_2 indicator. Some makes automatically trap off at regular intervals a constant volume, say 100 cubic centimeters, from a continuous stream of gas taken from the last pass. This trapped off portion of gas is brought into contact with caustic potash, which absorbs the CO_2, and a record is then automatically produced on a chart showing the amount of CO_2 in the sample of gas. If a boiler is working 12 hours a day the potash must be changed every 20 days. The Great Western Power Company in their Oakland steam plant uses a non-automatic CO_2 indicator. In this there are less parts to get out of order.

Thereupon the meeting adjourned.

WIRELESS IN GERMAN FISHERIES.

Consul-General Robert P. Skinner, writing from Hamburg, describes the use of wireless telegraphy among German fishing vessels: Three Cuxhaven steam trawlers are now equipped with apparatus, and the service is so satisfactory that efforts are being made to increase it. The most marked advantages resulting from the use of the wireless telegraph in this business are the ability of captains to advise with each other at sea as to their respective catches, and the transmission of similar reports to Cuxhaven a number of hours before the return of the ships to port. Thus vessels of the same fleet which have found poor fishing are sometimes able to join other vessels more fortunately located, in time to return with good catches. All the vessels are then able to inform the managers of the public markets respecting the quantities of fish to be placed on sale, in such manner that in the event of unusual catches arrangements can be made in advance for distributing supplies in the least possible time. The receipt and transmission of hydrographic intelligence and reporting of breakdowns in engines, or other accidents of navigation are also features of importance.

Examination for testing engineer is announced by the United States Civil Service Commission on July 27, 1910, to fill a vacancy in the position of engineer in timber tests, $1200 per annum, Forest Service, Madison, Wis., and vacancies requiring similar qualifications as they may occur.

THE HISTORY OF GAS-LIGHTING IN SACRAMENTO.

BY E. C. JONES.

Sacramento, the capital of California, derived its name from the Spanish of the ecclesiastical word sacrament, meaning "an outward and visible sign of an inward and spiritual grace." The story of how the Sacramento Valley was explored and settled by Captain John A. Sutter recalls the experiences of the pilgrims who first made their homes on the shores of Massachusetts Bay nearly three hundred years ago. This pioneer settler of California was confronted by all the hardships, disappointments, and dangers of the Puritans, with the single exception of the wonderful advantages of California climate. But the troubles of the California pioneer were ever tempered by sunshine and warmth. Seventy years ago, and well within the memory of many who are still living, the site of the present city of Sacramento was little known to white men and was occupied by hostile tribes of Indians.

Captain Sutter had received information in his Missouri home as to the mildness of California's climate and the productiveness of its soil, and he was filled with enthusiasm to be among the first to settle in so attractive a country.

He left Missouri in April of 1838 with a small company bound for California. The overland journey was slow and full of difficulties. He attempted to reach California by way of the old "Oregon trail." But when he reached the Willamette River his men deserted him. So he took passage on a Hudson Bay Company's vessel that was going to the Sanwich Islands. He hoped that he would be able there to reship to the coast of California. But he was disappointed, and left the islands in a vessel bound for Sitka. After some delay he came down the coast in the brig "Clemintine" and arrived at Yerba Buena (now San Francisco) July 2d of 1839. As Monterey was then the only port of entry he was compelled to go to that point before the vessel could be formally entered in accordance with the Mexican custom-house regulations.

At Monterey Captain Sutter explained to Governor Alvarado the interest he had long felt in California, and expressed his desire to settle in the Sacramento Valley.

The Indians of the northern part of California had all along been hostile to the settlement of Mexicans in their territory, so the proposition of Captain Sutter to locate in that dangerous region was favorably received. He was given permission to explore the rivers and to select and take possession of any location that pleased him, and was assured that after one year from the time of settlement he would be given title to the lands. With this encouragement, he returned to Yerba Buena, chartered the schooner "Isabella," purchased some small boats, and began the exploration of the Sacramento River. He was eight days in discovering which was the main channel of the river, and then he sailed up-stream to within ten miles of the present city of Sacramento. He was met by armed and painted Indians. But he succeeded in satisfying them of his peaceable designs, and a treaty was made. He was allowed to proceed up the river, accompanied by two Indians, and he ascended in his schooner as far as the mouth of the Feather River, and in small boats went on up the Sacramento some distance further. After exploring the country he returned to his little schooner and found his men in a state of mutiny. They demanded that he should abandon so foolhardy an expedition in that useless wilderness. But Captain Sutter was determined to succeed, and he returned to the mouth of the American River, which he entered August 12th of 1839. He ascended the American River about three miles, discharged there the cargoes of his boats, pitched his tents, and mounted small cannons as a means of defense and to intimidate the Indians. Here he broke the spirit of insubordination among his men, but the party was divided. Three white men decided to remain with Captain Sutter. Although satisfied as to the bad faith of the natives, he hoped to gain their assistance in carrying out his designs.

The Indians were scattered over the country in tribes and had their rancherias located at various points in the valley, along the course of the streams. At the time of Captain Sutter's arrival one of the most powerful of the tribes were the Nemshous, who ranged between the Bear and American rivers. Across the Sacramento were the Yolos, and on the north side of the American were the Bashonees. The Indians found by Sutter were degraded and worthless, inhabiting miserable mud holes or adobe huts, and subsisting on fish, acorns, roots, and small game. They were too lazy and stupid to hunt the larger game, which was so plentiful in the country at that time.

The first site Sutter selected on the American River was a place now known as Stewart's. But it was not entirely satisfactory. So Captain Sutter began in 1840 building Sutter's Fort at its present location. In 1841 an adobe building was constructed at the first landing, a place known later as the Tan Yard. Soon after that Sutter constructed a good-sized adobe house of two stories and three smaller houses, all surrounded by a wall, and these comprised Sutter's Fort. This work was accomplished by enlisting the labor of friendly Indians, whom he had succeeded in partially civilizing. These Indians were then employed in opening a road through the chaparral to a landing point on the Sacramento River two miles distant and called the Embarcadero. This name was retained until 1849, when it was changed to Sacramento.

Captain Sutter had enclosed a large tract of land with a ditch, and had commenced the cultivation of the soil. In two years he had established himself in power and authority. He surrounded himself with the best obtainable mechanics. Work of various kinds was carried on within the walls of the fort. He also formed a company of soldiers, selected from the best of the natives of the country. And when Fremont, "the pathfinder," arrived from the East he found at Sutter's Fort forty Indians in uniform, thirty employed white men, and twelve pieces of mounted artillery. Sutter's Fort was then capable of holding one thousand men, and there were two vessels at the Embarcadero belonging to Captain Sutter.

During the rebellion in 1844 Captain Sutter was called upon to aid in sustaining the Mexican government. As a result of that little revolution Pio Pico was

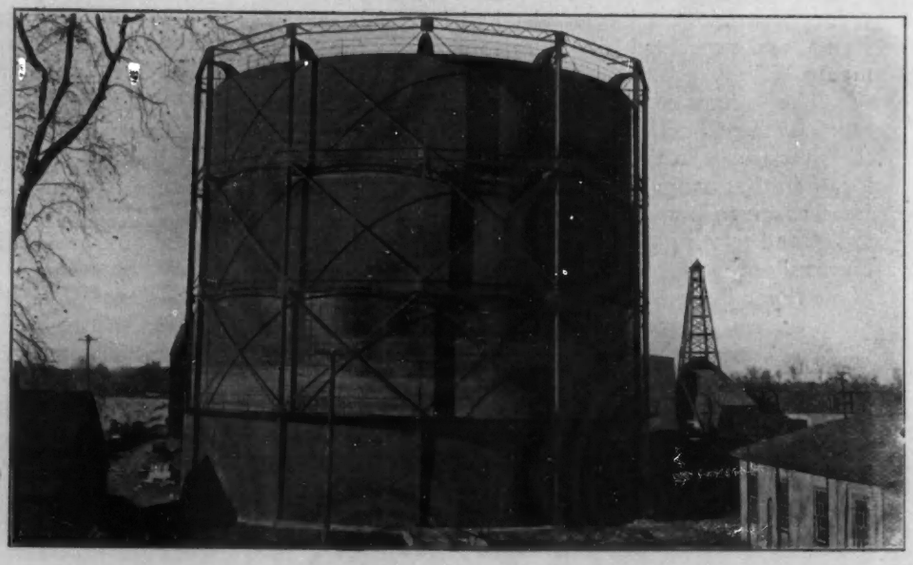
made governor, and he retained the office until the war with the United States. A revolution later broke out among the Americans, who, before the Mexican war, took possession of Sutter's Fort and raised the first flag of independence. This movement was known as the Bear Flag Revolution, from the revolutionists' banner, on which was painted an emblem representing a grizzly bear. During this encounter General Vallejo and other Mexicans were held as prisoners at Sutter's Fort for about three weeks.

The war between the United States and Mexico began in May of 1846, and Commodore Sloat was directed to occupy the ports of upper California. The 7th of July the American flag was raised in Monterey, the 9th of July at the plaza at Yerba Buena (now Portsmouth Square in San Francisco), and soon after at Sutter's Fort and other places.

After the arrival of James Marshall, a millwright, Captain Sutter determined to build a sawmill. They selected a location far up on the American River at what is now Coloma. This place had all the natural advantages necessary for the successful operation of a sawmill. Marshall, with seventeen men, began in the winter of 1847 to build the mill. In January of 1848, while Marshall was employed in enlarging the millrace, he made the first discovery of gold in California. Marshall hastened on horseback to report his discovery to Captain Sutter at the fort, where he exhibited about two ounces of scale-like particles of gold. Captain Sutter desired to keep this discovery a secret, as he was depending on the mill at Coloma for lumber which he needed for building operations. But it was impossible to conceal a fact so important and interesting. Despite all precautions, the quiet mining operations were discovered. A general stampede resulted. The discovery of gold caused a rush to the diggings. Seekers of gold made their way up the Sacramento River. The first party of these gold-seekers landed at the Embarcadero November 2d of 1848. There was not a house there. The only place of business of the future Sacramento

Sutter's Fort, Now Within the City of Sacramento.

General View at the Sacramento Gas Works.



The 500,000-Cubic-Foot Gas Holder at the Sacramento Works.

AN OLD GROUP AT THE SACRAMENTO GAS WORKS.
Left to right—John Hines, Jim Cousins, Harry Keefe (in white), James Apple, Supt. George W. Jackson, Engineer Dennis Brophy, John Logue, John Brophy (hat at chin), Pat Spain, James McGunigan, J. Francis, Con McCann (bare arms), John Quigley, James Quillinan (shovel), John Roach.

was an old store-ship aid up by the bank trade and a little town in itself. It was rented to merchants at $60,000 a year. The principal establishment was the general store of Samuel Brannan & Co. At that time flour was sold at $60 a barrel, pork at $50 a barrel, and sugar at 25 cents a pound.

In December of 1848 Captain William H. Warner surveyed and laid out what is now the city of Sacramento. The first building in the new town was erected by Samuel Brannan, and it was completed January 1st of 1849. It was located at the corner of J and Front streets, and stood there until the fire of 1852. During all this time the town of Sacramento remained under the nominal government of an alcalde, or mayor. But with the 1st of August of 1849 a meeting of a town council was held, and after six weeks' deliberation the councilmen submitted a draft of a city charter. This proposed charter was defeated by 146 votes, but was afterward approved by a majority of 295 votes.

The population of Sacramento October 1st, 1849, was 2000, and at that time there were forty-five wooden buildings and three cloth houses in the town.

One evening in January of 1850 the town was suddenly inundated by a rise of the river. So high did the water come that vessels of ordinary size could sail as far in as Sutter's Fort, and the entrance to the City Hotel was from boats landing at the second-story windows. This flood lasted but a few days. The 7th of April the waters again flowed into the town, and the day following the city council voted an appropriation for constructing a temporary levee. When this work was accomplished the principal business districts of Sacramento were protected against flood water.

This enterprising young city was the second in the State of California to introduce illuminating gas. Many interruptions prevented the completion of the gas works. July 15th, 1854, the city was nearly destroyed by a fire which consumed ten entire blocks in the central part of the town with more than two hundred frame buildings. During that year a new levee was constructed, one thousand new houses were erected, one hundred and fifty of which were substantial brick improvements, and the streets of Sacramento were raised and planked to a grade above the high-water mark. Had it not been for unforeseen events the gas supply would have been the first public utility in Sacramento, then a town of some 8000 people. But during 1854 a water works was first installed. This was the first city water works established on the Pacific Coast.

The Old Office Building at the Sacramento Gas Works.

Pier on Sacramento River Where Fuel-Oil Is Delivered at the Gas Works.

The 25th of Februray, 1854, an act passed the Legislature declaring Sacramento the capital of the State, and March 1st, 1854, the Governor, State officials, and the Legislature arrived and were received by the city corporation, the Sutter Rifles, and the assembled citizens.

June 5th of 1854 a Scotchman named William Glenn obtained a franchise to build and operate a gas

works in Sacramento. This was the same year that gas was introduced in San Francisco. But Glenn did not proceed with the building of the works. He sold his right to others who organized August 18th, 1854, under the name of the Sacramento Gas Company. Angus Frierson was elected the first president, and N. W. Chittenden, the secretary.

October 20th, 1854, Mayor R. P. Johnson took the initial step in the construction of the gas works by turning the first soil in excavating for the gas-holder tank. The progress of the work was seriously interrupted, and the undertaking was abandoned March 7th, 1855, on account of the rise of the American River and the submerging of Slater's Addition, where the new gas works was being built.

But August 14th, 1855, work was resumed, and was carried to a successful completion.

Sacramento was first lighted by gas the evening of December 17th, 1855. At that time the officers of the company were R. P. Johnson, president; P. B. Norman, engineer; H. W. Watson, secretary; D. O. Mills, treasurer; and James Murray, W. F. Babcock, L. McLean Jr., R. P. Johnson, and W. H. Watson, directors.

The retort house was a brick structure 54 ft. long, 51 ft. wide, and 21 ft. high, covered by an iron roof. The adjoining purifying house was 35 ft. long, 25 ft. wide, and 18 ft. high in the clear. The purifying house had a water-tight cellar built on arches. The meter house and offices occupied a building 37 ft. long, 25 ft. wide, and two stories high. A great deal of pride was taken in the gas works' chimney, which was built of brick and was 85 ft. high.

The gas-holder tank was 52 ft. 6 in. in diameter and 20 ft. deep. It was made of brick and rested on a pile foundation. The buildings and brick-work were constructed by Carr and Winons of San Francisco, and all of the iron-work was furnished by James and Peter Donahue of San Francisco.

In 1856 the average daily output of gas was from 8,000 to 10,000 cu. ft. The selling price was $15 the thousand, and there were 113 consumers.

In 1863 the number of consumers had increased to 600, and then the city contracted for 45 street lamps at $9 a month each, the lamps to be lighted only during the session of the legislature! A new gas holder was constructed in 1869 with a capacity of 60,000 cu, ft.

February 1st, 1870, the price of gas was reduced to $7 the thousand cu. ft., and there were at that time 33,000 ft of street mains in use. During that same year the price was further reduced to $6 the thousand, at which rate it was held for several years.

In 1871 there were 50,000 ft. of gas mains in the streets of Sacramento. The officers of the company at that time were Charles E. McLane, president, and H. B. Forbes, secretary, and John Q. Brown was the superintendent. January 8th, 1872, opposition came into the field under the name of the Citizens Gas Light and Heat Company. The trustees of this new concern included many well-known men of Sacramento, and the first officers were W. E. Brown, president; Robert C. Clark, vice-president; Albert Gallatin, treasurer; and J. W. Pew, secretary. This Citizens gas company proceeded to build a works on a 600-by 240 ft. area on the river-front, between T and U streets. The erection of the works began there in February of 1873, and the plant was completed in December of that year. Eighteen miles of street mains were laid. The plant included a substantial retort house, containing 5 benches of 5 retorts each, a purifying house, and all the apparatus necessary for a complete coal-gas works, also a brick office building, which contained an 8-ft. station meter and rooms for the directors and for the transaction of the regular business of the company. This gas works was the nucleus from which has grown the present well-equipped works of the Sacramento Electric, Gas and Railway Company of today.

January 1st, 1875, the Sacramento Gas Company and the Citizens Gas Light and Heat Company were consolidated under the name of the Capitol Gas Company, with a capital stock of $2,000,000 in 40,000 shares of $50 each. The gas-making operations of the new combination company were carried on at the works of the Citizens' Gas Light and Heat Company, between T and U streets and Front street and the river-front. At this works there were three 60,000 cubic foot gas holders for the storage of gas. These holders continued to be the sole dependence of the company until the construction in 1908 of the 500,000-cubic-foot modern gas holder.

In 1878 the retort house of the Sacramento Gas Company was sold and converted into a warehouse, and the railroad company bought the old gas holder and the land on which the holder had stood. So the plant of the Sacramento Gas Company, with the exception of its street-main system, passed out of existence.

When the present State constitution was adopted the capital stock of the company was reduced to 10,000 shares, at a par value of $50 a share.

The report of the superintendent, John Q. Brown, for the year ending 1876 gives the amount of gas made that year as 36,033,000 cu. ft., with a leakage of 17 per cent. It deals with the re-arranging of the mains and services due to the consolidation of the two companies, and states that all of the apparatus at the old works was taken down and that those parts in good order were utilized for improvements and additions to the new works.

During 1876 quite extensive improvements were made to the works that had been acquired by the consolidation and five benches of retorts were added, making ten in all. That year there was constructed a new coal shed, 40 by 120 ft. This shed remained in use until it was dismantled during the month of December, 1909.

In 1876 the gas was made from Sydney coal, costing $12 the ton, enriched with "kerosene shale" from Australia and costing $25 the ton.

In 1887 the officers of the Capitol Gas Company were B. U. Steinman (afterward mayor of Sacramento), president; Oliver Eldridge, vice-president; and C. H. Cummings, secretary and treasurer.

March 21st, 1887, John Q. Brown resigned as superintendent of the gas works to accept the position of state gas inspector, and was succeeded temporarily

by J. R. Watson, who, in turn, was succeeded September 1st of that same year by George W. Jackson as temporary superintendent. Jackson was then clerk of the company, and J. C. Pierson was appointed the permanent superintendent. Pierson retained this position until 1894, when he retired to attend to his mining interests. He was succeeded as superintendent by George W. Jackson.

July 1st, 1887, the Capitol Gas Company consolidated with and absorbed the Thomson-Houston Electric Light Company, thereby disposing of a competitor and combining the electric-lighting and the gas business.

In 1896 the Sacramento Electric Gas and Railway Company was formed by the consolidation of the Sacramento Electric Power and Light Company and the Folsom Water Power Company, and in 1902 this company acquired by purchase the Capitol Gas Company.

In March of 1903 the Sacramento Electric Gas and Railway Company was acquired by the California Gas and Electric Corporation. During the many changes in corporate title and the advancement in the art of gas-making the method of making gas was also changed.

A plant for the manufacture of water-gas from anthracite coal and petroleum was constructed, and it was used in connection with the coal-gas works. As petroleum became more plentiful and cheaper, water-gas displaced coal-gas.

In 1903 another advancement in the process of manufacture was made by the introduction of crude-oil water-gas, using California petroleum exclusively for the manufacture of gas. With the development of the process of making gas the quality was improved, and the price was reduced to $1 the thousand cu. ft. which is the rate now charged in Sacramento.

The late George W. Jackson was succeeded as superintendent of the gas works by R. P. Valentine, and when the company passed into the hands of the California Gas and Electric Corporation the late Albert Gallatin was made its manager. Then in turn came Frank A. Ross and F. E. Fitzpatrick as managers.

In January of 1906 the Sacramento Electric Gas and Railway Company became a part of the Pacific Gas and Electric system, and is now under the management of C. W. McKillip, with Edward S. Jones as superintendent of the gas works.

Since the Sacramento works has passed into the hands of the Pacific Gas and Electric Company great improvements have been made in the plant, new and larger sets of oil-gas generators have been installed, new purifiers have been constructed, and a 500,000-cubic-foot storage holder has been built. The street-main system has also been extended to keep up with the growth of the city, and a high-pressure gas system has been installed at Oak Park, a large and rapidly growing suburb of Sacramento. In 1909 it was decided to increase the oil-storage capacity at the gas works, and a 10,000-barrel, steel oil-tank was placed upon a barge in San Francisco and towed up the Sacramento River, moved over the levee, and placed upon a foundation in the yard at the gas works.

CLEANLINESS AND ECONOMY IN POWER PLANTS.[1]

BY THOMAS J. WALSH.

It will be my endeavor briefly to point out to what extent the costs entering into the production of power may be affected by the proper attention to cleanliness about the power station.

The added exertion necessary to keep equipment and building tidy and free from accumulation of dirt, with all its attendant influences on the deterioration of the apparatus, is so slight, while the benefits are so marked, that there can be no question as to its expediency. No one will deny that the replacing of tools and supplies in their proper places, the removal of foreign matter from any part, the gathering up of waste scraps for easy disposal, the tightening of a loose joint or the replacement of a fractured pipe or fitting in the oil piping, require but the minimum of attention at the appropriate time. Few things are more disheartening to an engineer than the wail of a "dying" turbine, or the laying down of an engine under load, especially with the tools scattered about the plant. Then, too, when the cleanliness of engines and boilers is neglected, the increase in coal consumption becomes at once noticeable; and where there is leaky oil piping, the oil bills must increase as oil is thrown about the engine room floor and into fly-wheel pits, or into generator windings and commutator with destructive effects, especially when the cleaning is neglected.

No stronger proof could be brought forward as to the efficacy of the attentions as urged here in this article than the consideration of the power plants of Holland. The wonderful economic results obtained from the obsolete equipment in those stations was remarked some time ago by the editor of the Street Railway Journal, and together with these economic results was mentioned the remarkable cleanliness of everything about the plant, not only superficially, but of the invisible parts as well.

And in our own country it is only necessary to observe those stations where economy in the production of power is the aim of the entire personnel, to obtain added proof as to the advantages of cleanliness. One need not look for highly polished brass railings or nickel-plated tools, but one does find no waste of oil, every tool in its place, an orderly supply cabinet or locker, convenient receptacles for clean and dirty coal, feed pumps and lubricators free from accumulation of dust. These will be the most marked, but it is safe to predict that these visible signs are faithful indications of an excellence in the maintenance of the internal parts of the equipment.

As affecting the costs entering into the production of the output, the boiler room contains great possibilities of economic results where cleanliness is properly attended to. The confining of coal in neat piles on the firing floor, or in the containing cars, is not only pleasing to the eye, but firing and the cleaning of fires is simplified by the freedom afforded the firemen in moving about, and furthermore the coal does not become mixed with the ashes. Clean fires and clean

[1]Public Service Journal.

ashpits mean efficient combustion as well as increased capacity. Clean drums and tubes, internally and externally, are likewise necessary for efficiency, an instance being known where an ordinarily well operated station increased its rate of coal consumption two and one-half per cent by neglecting the daily blowing or dusting of tubes for a week. And aside from the reduced coal consumption this cleanliness means longer lived grates and tubes, with the resulting decrease in maintenance charges. Clean feed pumps, plungers or rods protected or kept free from grit, insure a longer life to those parts, as well as a reduction in charges for waste, drip pans under the auxiliaries, neat piles of packing; while lubricators similarly attended to provide clean oil at all times to still further reduce the friction to be overcome. And increased friction means increased coal consumption.

In the engine room a systematic overhaul and cleaning of all parts, internal as well as external, reduces maintenance charges to a minimum, the consequence being increased useful life to the machine. Inspection of engine cylinders and turbine rotors discloses accumulation of carbon, scale and other foreign matter that may easily counteract much of the care devoted to the boiler room equipment previously mentioned. Carbonized oil, due to an excess of lard or tallow, or metal flake carried over from the boilers with the steam, while blocking up steam ports of valves, is also sure to cause scored cylinders; and under certain conditions blades of turbines will accumulate scale to a degree hardly imaginable, but which is only disclosed by inspection, such a condition being obviously destructive of all the refinements accorded to the previous stages in the chain of conversions. Bearings, pins and boxes likewise need only to be examined to bear out this discussion, indicating the necessity for frequent cleaning of oil grooves if lubrication is to be effective.

This argument extends to the other machines making up the engine room equipment.

Care should be given to offices and workshop in the same way; the effect of such a general scheme of cleanliness could not but be beneficial to each member of the operating crew.

As affecting the fixed charges, the surplus capacity in a plant could reasonably be lower where operating engineers of a high grade were known to be in charge, men who would insist upon the maintenance of all equipment in first-class operating condition. In this way the investment charges might be materially reduced. As to the depreciation charges, the assumption of a continued regime of cleanliness would hardly justify a reduction; yet to find at the end of its useful life in a particular station—or when it shall have been superseded—that the depreciation on a machine has been overestimated, is a much more satisfactory outlook than would be the reverse.

So, too, oily waste thrown around and oil saturated floors — particularly in wooden structures — increase the fire risk, and this must be provided for by a higher insurance rate.

Granting then the improved efficiency of the equipment, as well as of the men, and the possible reduction in investment, depreciation and other fixed charges, it becomes obvious that for the successful operation of a power station the first essential is cleanliness.

A systematic and careful cleaning of every piece of apparatus in use in the station will in the beginning disclose weaknesses to be attended to before becoming too serious. The application of a wrench to a loose nut or bolt, or the careful cleaning of electrical apparatus from oil, might easily prevent highly destructive consequences. This attention should be given not only to the main units but also to pumps, heaters, condensers, all piping, traps, oil tanks, filters, water measuring devices, scales, motors, rheostats, switchboards, instruments, etc. Thus the concerted action of the whole operating crew will avert the time when the failure of a machine through neglect will mean hours of strenuous labor, with correspondingly high maintenance charges for the renewal of parts, and a serious crippling of the service.

THE WATTHOUR METER.

BY WM. M. SHEPARD AND ALLEN G. JONES.

(Continued.)

APPENDIX.

Definitions.

In many respects electric circuits closely resemble a water system, in which the pressure is analogous to the voltage of the electric circuit and the quantity (in cubic feet per second) to the current flowing in the wires. This comparison will often aid in the solution of various electrical problems.

Definitions.

Ampere—the unit of electrical current, and is that current which will deposit silver at the rate of 0.001118 grams per second when flowing through an electrolytic solution of silver nitrate.

Ohm—the unit of resistance, and is equivalent to the resistance of a column of pure mercury, at 0° centigrade, 103.6 centimeters high, of uniform cross section, and weighing 14.4521 grams.

Volt—the unit of electrical pressure (electromotive-force), and is that pressure which will maintain the flow of one ampere of current against the resistance of one ohm.

Let R=the resistance of a given circuit, E the voltage impressed and I, the current in amperes, then for direct current,

$$E = R \times I \text{ (Ohm's Law)},$$

which is the fundamental equation of direct current circuits.

Watt—the unit of electrical power; the watts equal the product of the volts and the amperes in direct current circuits, and to the product of the volts, the amperes and the power factor in alternating current circuits. (See Chap. II.)

Kilowatt—one thousand watts.

Watthour—the unit of electrical energy, and is equivalent to the flow of one watt for one hour.

Kilowatt-hour—one thousand watthours.

Inductance: The inductance of an electrical circuit is the property of that circuit whereby it can convert electric energy into magnetic energy, and vice versa.

Inductance bears a close resemblance to "inertia" in mechanics, and has been called "electrical inertia." Inertia is that property of a moving body whereby it resists any change in its velocity; if a rapidly moving body is suddenly stopped, as, for example, a hammer striking a nail, a great force is exerted by the body against the obstacle which brings it to rest; the magnitude of the force depending upon the suddenness with which the moving body is stopped and upon the inertia of the body. In an electric circuit containing inductance, if the current is suddenly interrupted, a high e.m.f. is produced which tends to cause the current to continue. The magnitude of this "induced" e.m.f. depends upon the suddenness with which the current is interrupted and upon the inductance of the circuit. The inertia of any given body is proportional to its mass; the energy stored in a moving body is $W = \frac{1}{2} MV^2$, where M is the mass (= weight divided by the gravitational constant), and where V is the velocity. The magnetic energy stored in an electric circuit due to its current and inductance is $W = \frac{1}{2} LI^2$, where L is the inductance and I is the current.

Henry—unit of inductance; a circuit having an inductance of one henry will have an e.m.f. of one volt induced in it by a current changing at the rate of one ampere per second.

Milli-henry—0.001 henry.

Power Factor—the ratio of **true** watts to **apparent** watts (see Chap. II).

Cycle—one complete wave or alternation of current or e.m.f. (See Fig. —, Chap. II.)

Frequency—number of cycles per second.

Impedance—the **vector** sum of the resistance and the reactance of an electric circuit and is expressed by the following equation:

$$Z = \sqrt{R^2 + X^2},$$

in which R is the resistance in ohms, and X is the reactance ($= 2\pi f \times L$, where f is the frequency in cycles per second and L is the inductance in henrys). The voltage drop in an alternating current circuit containing both reactance and resistance is

$$E = Z \times I,$$

where Z is the impedance as above expressed and I is the current in amperes.

Determination of Temperature Rise by Resistance Method.

In testing electrical machinery such as generators, motors and transformers, it is impossible to obtain the internal temperature of the windings by use of thermometers; the following formula will therefore be useful in determining the **average** temperature of such windings:

$$\text{Rise in temperature} = (238 + t)\left(\frac{F}{R} - 1\right) \text{degrees C},$$

in which 238 is a constant; R is the initial resistance of the winding at a room temperature, t, and F is the final resistance. If the room temperature differs from 25° C, the calculated temperature should be corrected by ½% for each degree C. Thus with a room temperature of 15°, the rise in temperature should be increased by 5%, or if the room temperature is 35°, the rise in temperature as calculated should be decreased by 5%, etc.

Adjusting Meters for Use With Current and Potential Transformers.

The usual method of testing watthour meters used with current and potential transformers is to test and adjust the meters without the transformers, taking into consideration, of course, the ratio of the transformers. Where a great degree of accuracy is not required, this procedure will answer very well; but where, as with large consumers, a small percentage error represents a considerable sum of money, the errors introduced by the current and potential transformers should be taken into account and, as far as may be, compensated.

The errors introduced by the current and potential transformers are (1) errors in ratio of the transformers and (2) errors due to improper phase relations between the primary and secondary currents and e.m.f's.

The errors due to ratio can be easily compensated by adjusting the meter in accordance with the ratio curves of the transformers at unity power fatcor. The ratio of the potential transformer will remain constant as its load is constant. The ratio of the current transformer will not remain constant, but will vary with the load. It tends to make the meter fast at full load and slow at light load. This can be compensated by adjusting the meter to be a little slow at full load and fast at light load.

The errors due to improper phase relations between the primary and secondary currents and e.m.f.'s are of more serious nature and more difficult to eliminate than errors due to ratio. The errors from this source are negligible at unity power factor, but may be considerable at low power factors, depending on the design of the transformers.

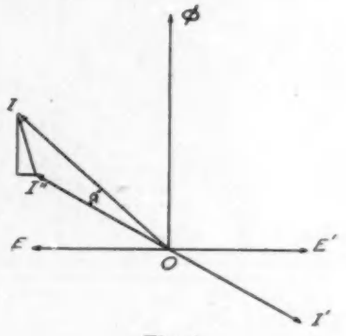


Fig. 1.

The diagram, Fig. 1, shown below, is a vector diagram of a current transformer. OI is the primary or line current, OI′ is the secondary current and lags behind OE′, the secondary e.m.f. of the current transformer, by an angle depending on the power factor of the secondary load (meter coils and leads). II″ is the exciting current, the magnetizing component of which is at right angles to and the energy component in phase with the primary e.m.f., OE, of the current transformer. OI″ is that component of the primary current inducing a current in the secondary, or is the secondary referred back to the primary. It will be seen that OI′ leads OI by and angle α which will tend to make the meter run fast on inductive loads.

(To be continued.)

CALIFORNIA OIL FUEL.

BY R. F. CHEVALIER.

GAS ANALYSIS (Continued).

Manipulation.

To obtain a sample of gas for analysis, connection is made with rubber tubing between the free end of the connecting tube D and a sample tube inserted either in the stack or pass of the boiler to be tested. The gas is first collected in burette B for measurement. This measuring burette is usually of 100 cubic centimeters capacity and, as already mentioned, is surrounded by a glass cylinder containing water for the purpose of maintaining the gas at a nearly uniform temperature.

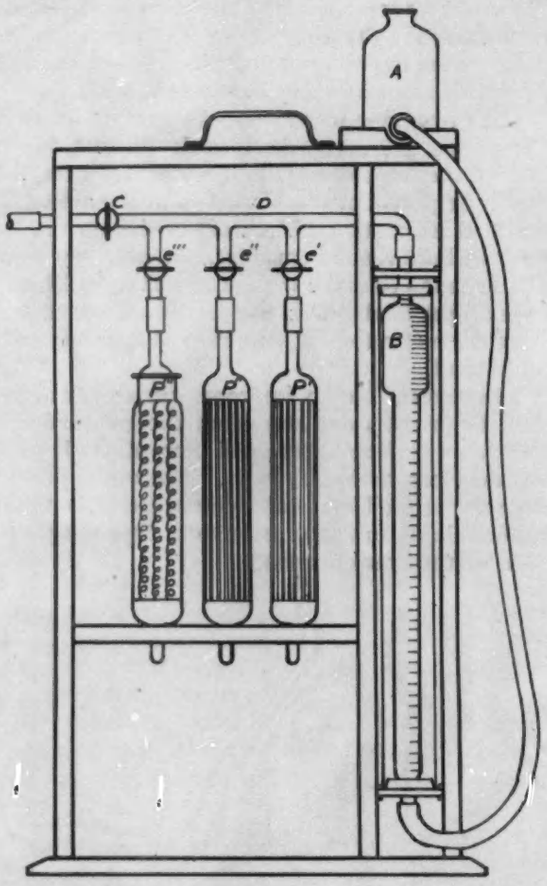


Fig. 1.

The first 50 cc of the burette are in divisions of 0.2 cubic centimeter, the remaining in one cubic centimeter divisions. To fill B with the gas to be sampled, cocks e' e'' e''' are closed and cock C is turned horizontal, at the same time lowering bottle A until the gas in B reaches the zero point. This first sample collected is not the true sample. The sample tube and connecting rubber tubing are filled with atmospheric air which must be withdrawn. On reaching the zero point or thereabout, C is turned so that upon raising the bottle A the gas or air in B is expelled to the atmosphere, and when the water in B reaches the 100 cc mark C is again turned horizontally, simultaneously lowering the bottle A, thereby drawing another sample from the tube and again expelling to the air. This operation must be repeated three to five times, according to the capacity of the sample and connecting tube. The air in the tubing being finally displaced B is carefully filled with gas to the zero point (100 cc or parts) and C closed. All measurements are made by bringing the level of the water in the bottle to the same level as the water in the burette. Particular attention must be paid to this method of reading measurements, for if the bottle is raised or lowered, the gas will be compressed or expanded. A certain amount of water clings to the side of the burette, which, if given time, will drain; therefore all measurements should be made accordingly, i. e., if thirty or sixty seconds are allowed to elapse between leveling the water in bottle and burette, and the reading, the same time should elapse between these events when another measurement of the same sample is made.

The order of determination and respective pipettes for the gases are as follows:

1st—carbon dioxide (CO_2) .....Pipette P'
2nd—oxygen (O) .....Pipette P''
3rd—carbon monoxide (CO) .....Pipette P'''
4th—nitrogen (N) .....by difference

Determination of Carbon Dioxide.—To determine the carbon dioxide the stop cock e' is opened, the bottle A raised, forcing the gas into P'. The gas displaces the reagent in the front and forcing it to the rear part of the pipette, exposes the glass tubes, which, covered with reagent, offer a large absorption surface. A is lowered again until the reagent is brought approximately to its initial point in the stem, when the bottle is again raised and again drives the gas into P'. This operation is repeated three or four times, when the gas is returned to the burette for measurement, the reagent brought to its initial point on the stem, and the glass cock C' closed. The water in bottle A is leveled with that in the burette, and the reading taken The difference in volume is the CO_2. The burette is marked so that the difference in volume may be read in per cent.

Determination of Oxygen.—After measurements, the residue from the absorption of carbon dioxide is passed into P'' in the same manner until no further diminuation takes place. The absorption of oxygen is much slower than that of carbon dioxide. The difference between the reading obtained, and that after the absorption of carbon dioxide is the per cent of oxygen in the gases. Fastened to the neck, at the rear of pipette P'' is a rubber bag to keep out the atmospheric oxygen, at the same time allowing the air in the pipette to be displaced.

Determination of Carbon Monoxide.—The gas is then passed into P''' for absorption of carbon monoxide, but before being measured, the gas must be passed into P' to remove hydrochloric acid vapors retained by it after contact with the reagent for carbon monoxide. The per cent of CO being small and the gas difficult for a reagent to act upon, considerable skill is required for this determination. The method of measuring the gas in the burette is similar to that already described for CO_2 and O.

Nitrogen.—After the absorption of the above gases, the residue left is usually nitrogen. In some instances, hydrogen exists, but its determination is rather difficult.

(To be continued.)

THE MECHANICS OF THE STEAM ENGINE.

In the Journal for June 11, 1910, a diagram for graphically showing the velocity of the crosshead was given. The velocity was there found to be proportional to the vertical distance from the shaft center to the connecting rod (extended if necessary). In Fig. II this velocity was shown to be proportional to the length OS.

By this diagramatic construction it will be noted a velocity is represented as a definite length of line. If, now, we can determine the rate of change of the length of this line; that is, the velocity of one end away from the other due to the line's lengthening, we shall have a value for the acceleration of the crosshead. For the change of velocity of the crosshead is represented by a change in the length of the line OS and hence the rate of change of the line's length will represent the rate of change of the crosshead velocity, that is to say, its acceleration.

Professor Le Conte has shown this by an interesting extension of the above mentioned figure.

In Fig. V the crosshead velocity is again indicated by the length OS.

Consider, for the purpose of reasoning, that the point S is actually a point in the connecting rod. By the use of the instantaneous center I the velocity of S is found to be in a direction and of the value of SN. The construction for this is to draw an arc from Q to M with center at I and extend the tangent line Mu to equal the velocity of the point M. For instance, imagine the rough line to enclose a surface which is moving rigidly with the connecting rod. The velocities of all points in this surface will be at right angles to the line connecting such point to I, that is, tangent. In the case of the point M the velocity will be equal to that of Q since their distance from I is the same. The velocity of S, however, will be greater as shown by the triangle NSI, but will be parallel with Mu. S, then, considered as a point of the connecting rod is moving in a direction and equal to the line SN.

By parallelogram construction this velocity is resolved into two components, one in the direction of the connecting rod Su and the other vertical ST. It is the vertical component in which we are interested. This line ST represents the velocity of the point S in a vertical direction. But the velocity of S is the acceleration of the crosshead. Therefore, ST is equal in length to the acceleration of the crosshead on the same scale that OS in length represents the velocity of the crosshead.

The following example will help to a thorough understanding of this construction.

In Fig. V assume the following:

Length of crank, OQ..... 20 inches
Revolutions per minute.....160

Then the velocity of the crank pin will be $2 \times 3.14 \times 20 \times 160 = 20{,}000$ inches per minute or 333 inches a second. When the crank is in a vertical position the velocity of P is for the instant equal to that of Q; also the point of intersection S, of the connecting rod with the vertical line through O is at this instant the crank pin itself. The length of the crank, then, or 20 inches will represent 333 inches per second velocity; or 1 inch on the line OS represents 16.6 inches per second of crosshead velocity. Thus our scale of velocity is determined. For any position of the crosshead its velocity may be determined by simply extending the line of the connecting rod till it intersects the vertical line through the shaft at S. Then OS in inches multiplied by 16.6 equals the velocity of P.

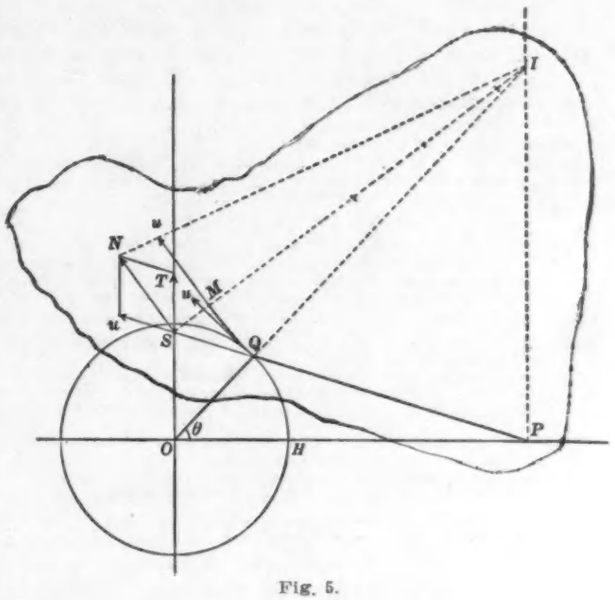


Fig. 5.

The velocity of Q = 333 inches per second, which is also the velocity of M. By measurement, or by comparing the triangles Mu will be found to be 9/10 of SN. Hence SN = $10/9 \times .333 = 370$ inches per second.

Also by either measurement or calculation ST will be found to be equal to $\frac{SN}{\sqrt{3}} = 213$ inches per second.

The velocity of S is therefore 213 inches per second. Hence the acceleration of P at the instant under consideration is 213 inches per second, which means that if the acceleration of P were constant for the second of time next succeeding the instant under consideration, the velocity of P at the end of this second would be 213 inches per second greater than shown (OS) or about $300 + 213 = 513$ inches per second. In reality the velocity at this latter instant of time would be different from this amount because the acceleration throughout the second would not necessarily remain constant, but the above numerical example illustrates the use of the diagram in determining instantaneous velocities and accelerations of the crosshead.

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE
Technical Publishing Company

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C. N. MANFRED, Eastern Manager

LOS ANGELES OFFICE, 107 SECURITY BUILDING

TERMS OF SUBSCRIPTION

United States, Cuba and Mexico	per year.	$2.50
Dominion of Canada	"	3.50
Other Foreign Countries within the Postal Union	"	5.00
Single Copies, Current Month	each	.10
Single Copies, prior to Current Month	"	.25

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office *ten days in advance of date of issue.* New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July 1895.
Entry changed to "The Journal of Electricity," September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1899.
Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Smokeless Combustion

A smokeless city, like a noiseless Fourth of July, is a matter of education. Persistent agitation has finally forced many cities to prohibit fireworks. The past week's reports show that as a result there has been much less fire havoc and fewer people have been injured or killed. While smoking chimneys have not exacted the same terrible death toll as exploding firecrackers, their cumulative year's damage to surrounding property and their involved waste of fuel gives a greater annual loss than may be ascribed to the fireworks of the festive Fourth. In consequence, anti-smoke ordinances have been adopted by many Eastern cities, so besmirched, and the question is now being investigated by certain Western bodies.

They find that smoke consists chiefly of unburned fuel. Hydrocarbons are volatile at temperatures far below their point of ignition and unless there be ample furnace space and abundant air supply, they are apt to escape up the flue unconsumed. If the furnace flame strikes the comparatively cold surface of the boiler shell before its burden of carbon dust and hydrocarbon vapor is all burned, it is extinguished just as by the wire gauze of a miner's safety lamp. Passing on as dense black smoke it poisons the air and pollutes everything which it touches. By enlarging the combustion chamber so as to interpose more space between the grate and the boiler the gases are burned before being cooled and the smoke is minimized. Such change in boiler design together with plenty of air will reduce not only the smoke, but also the fuel bill.

A certain amount of smoke from a power plant is as unavoidable as fleas on a dog, especially with fluctuating load. Many of the ordinances have been framed with this fact in mind and smoke of moderate density is permitted for periods of from four to fifteen minutes each hour, according to the diameter of the stack and the class of service, steamboats and locomotives being given the greatest latitude. Inspectors, armed with cameras, are employed to report noncompliance with the law and exact the fine. If half the time expended in trying to outwit the inspector were utilized in legitimate smoke prevention, the fuel bill, at least, would be the gainer.

Smoke is a nuisance in the eyes of the law and any reasonable ordinance intended for its abatement will be sustained by the courts. When the dirt that it creates and the discomfort that it causes become intolerable, the sufferers appeal to the lawyer for relief and drastic legislation sometimes ensues. This may be obviated by a little care and foresight on the part of the stationary engineers if they will but anticipate this inevitable effort for civic betterment by drafting and urging reasonable legislation. In other words, they should not leave to lawyers and politicians the regulation and even operation of their power plants.

PERSONALS.

Frank H. Ray of New York is at San Francisco.

F. F. Skeel, manager of Crouse-Hinds Company, is visiting the Pacific Coast.

M. C. Lord of Heald's College of Engineering, left this week for Seattle.

H. R. Noack, of Pierson, Roeding & Co., is in the mountains of Plumas county.

F. C. Ambridge has been appointed general auditor of the Fresno Traction Company of Fresno.

H. C. Rogers, the Denver manager for the Westinghouse Machine Company, is visiting San Francisco.

Seton Porter, of Sanderson & Porter, of New York, will spend a month or two at the San Francisco branch office.

F. A. Richards, manager of the car department of Pierson, Roeding & Co., returned last week from a Northwestern tour.

A. F. Hockenbeamer, second vice-president of the Pacific Gas and Electric Company, has returned from an extensive Eastern trip.

H. W. Noething has resigned as chief engineer of the Union Brewing & Malting Company of San Francisco, after seven years' service.

A. J. Meyers, Pacific Coast manager for the Wagner Electric Manufacturing Company of St. Louis, has returned from a northern trip.

O. A. Schlesinger, who was at one time with the Westinghouse Company, has joined the sales force of the Pacific States Electric Company.

W. W. Briggs, Pacific Coast manager for the Westinghouse Electric & Manufacturing Company, has gone to the mountains on a vacation trip.

Chas. Wiggin is in charge of the Los Angeles office of John R. Cole & Co., while Geo. Cole, the Los Angeles manager, is visiting San Francisco.

W. S. Heger, Pacific Coast district manager for the Allis-Chalmers Company, has returned from a trip to his Los Angeles office, where business has been excellent during the past month with good prospects.

K. G. Dunn, engineer with Hunt, Mirk & Co., representing the Westinghouse Machine Company on the Pacific Coast, has returned from a trip to Pittsburg.

C. H. Heilbron, a vice president of the California State Association of Electrical Contractors, came up from San Diego to attend the annual convention at the Palace Hotel.

R. C. Gilles, vice-president of the Mt. Hood Railway & Power Company of Portland, has been elected president of the Los Angeles-Pacific Company, succeeding E. C. Clark, resigned.

W. B. Woodill of Los Angeles, who is a vice president of the California State Association of Electrical Engineers, arrived the first of the week to attend the annual convention in San Francisco.

Paul Shoup, assistant general manager of the Southern Pacific Company, in charge of electric lines, went to Southern California last week on business connected with the taking over of the Fresno Traction Company.

A. G. Wishon has resigned as manager of the Fresno Traction Company, but will retain the management of the San Joaquin Light & Power Company and the Fresno City Water Company. He is succeeded in the traction company by F. W. Webster.

H. H. Noble, president of the Northern California Power Company, left last Tuesday for an inspection tour of his hydro-electric plants in Shasta and Tehama counties. He was accompanied by E. V. D. Johnson, the manager of the company, with headquarters at Redding.

N. A. S. E. HIGH JINKS.

California No. 1, N. A. S. E., will give a smoker and midsummer high jinks on July 14th at their hall, 172 Golden Gate avenue, San Francisco. A general invitation has been extended to many engineering societies to attend this meeting.

Newly elected officers of California No. 3, N. A. S. E., are: President, C. E. Van Meter; vice-president, C. M. Irwin; recording secretary, John Ostrom; financial secretary, Charles Knight; treasurer, Charles Dick; guide, W. G. Talbot; trustee, Wm. P. Millner; doorkeeper, John Hanna.

The new officers of California No. 1, N. A. S. E., as elected on June 30, 1910, are: President, P. L. Ennor; Vice-President, J. T. Stewart; Corresponding and Recording Secretary, C. H. Reinoehl, 73 Sharon Street; Financial Secretary, J. M. Wilson; Treasurer, Daniel Daniels; Conductor, D. A. Richardson; Doorkeeper, H. L. Gaskill; Trustees, Chas. Magnin, J. W. Maher, L. H. Honigbaum; Delegates to the National Convention to be held at Rochester, N. Y., Chas. Bankey, F. B. Dunn, H. L. Gaskill, and Wm. H. Kearney; Alternates to the National Convention, H. W. Noethig, J. W. Maher, J. T. Stewart and P. L. Ennor; Delegate to the Life and Accident Insurance Department, Wm. H. Kearney; Alternate to the Life and Accident Insurance Department, H. W. Noethig.

CONTRACTORS' STATE CONVENTION.

The annual convention of the California Association of Electrical Contractors opened at 10 a. m., Tuesday, July 5th, in the Music Room of the Palace Hotel, with President W. S. Hanbridge in the chair. Other officers of the organization present were H. B. Woodill, first vice-president; C. H. Heilbron, second vice-president; F. V. Meyers, secretary, and E. C. Wakeman, sergeant-at-arms. The attendance on the first day was small and the committee on credentials found that the 155 members throughout the State were represented by proxy by about 20 members actually present.

The opening address by President Hanbridge and the preliminary work of organization took up most of the first day. Out of the nine local districts of the State eight were represented by their officials.

The reports of various committees on routine matters were adopted.

Secretary Meyers reported that the financial condition of the Association was satisfactory. The discussion of subjects of importance to the contracting business occupied the remainder of the morning session.

At the afternoon session the reports of committees appointed at the last convention and at a meeting of the directors of the Association held at Santa Barbara in April, 1910, were heard and adopted.

During the afternoon the ladies accompanying the members from outside cities were given an automobile trip by San Francisco District Local No. 1.

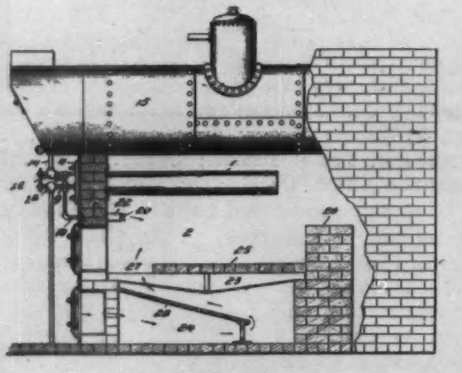
At 7 p. m. an elaborate banquet was served to members and invited guests in the large banquet hall of the Palace Hotel. Several entertaining speeches were made and the usual toasts were proposed, while the best of harmony prevailed.

Wednesday, July 6th, was devoted entirely to entertainment. San Francisco District Local No. 1 chartered the steamer Sehome for the day and arranged for the serving of luncheon on board. A large number of guests, including members of the State Association and their ladies and friends, embarked at the Clay-street Wharf and made a steamer tour around the bay and up the Sacramento River as far as Rio Vista, making brief stops at points of interest.

On Thursday business was resumed and the remainder of the usual routine was carried to a successful completion with a greatly augmented attendance such as it was impossible to secure on the opening day.

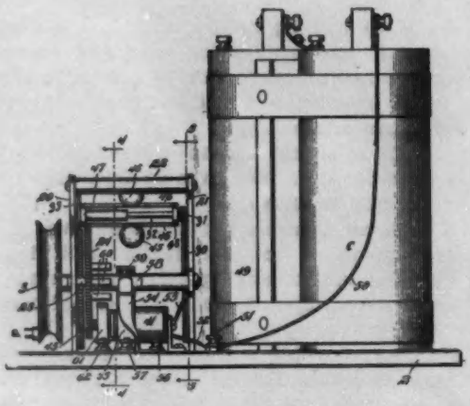
PATENTS

962,971. Burner. George J. McPherson, Salt Lake City, Utah, assignor, by direct and mesne assignments, to International Oil Gas Producer Company. An oil burner of the class described, comprising a superheating retort, a steam supply pipe extending thereinto and discharging at the inner end



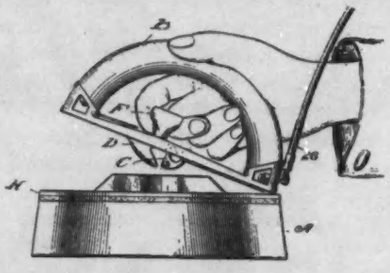
thereof, a gasifying retort located within the steam superheating retort, a feed pipe for liquid hydrocarbon extending into and discharging at the inner end of the gasifying retort, a mixing duct and connections between said mixing duct and said retorts to cause the superheated steam and gases to become commingled to produce a combustible mixture.

962,884. Thermo-Electric Furnace-Regulator. James H. Bobbitt, Harvard, Neb. In an apparatus of the class described, the combination of a thermostatically actuated circuit closer responsive to predetermined maximum and minimum temperature conditions, circuits connected with the said closer, draft regulating devices, and a motor mechanism controlled by the said circuit closer for operating the draft devices; said motor mechanism comprising a frame, a shaft mounted thereon, a wheel secured to the shaft, a weight-cord device for turning the wheel, a connecting element between the wheel and the draft devices, a contact finger mounted on



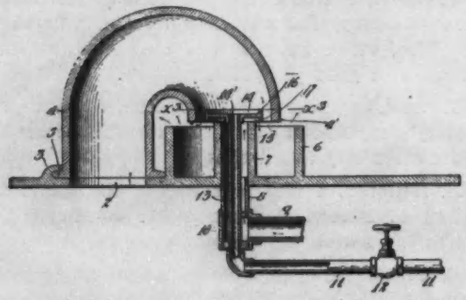
the shaft to rotate therewith, spring contacts with which the contact finger is adapted to engage, a brake disk, a shaft supporting the same, a train of gears between the shafts, a governor on the second mentioned shaft, and connected with the brake disk, means for rotating the governor from the first mentioned shaft, a brake shoe arranged to engage the disk, a lever mounted to release the brake shoe, an armature connected with the lever, an electromagnet arranged opposite the armature and adapted to be connected in circuits when the circuit closer is closed and the contact finger is in engagement with either spring contact.

962,768. Electric Sad-Iron. Henri G. Levy, San Francisco, Cal. In a device of the character described, the combination of a body portion and a removable handle therefor, said body portion having an electric-heater within it, and provided



with contacts, and said handle portion having contacts adapted to establish an electrical circuit through the first-named contacts and heater co-ordinately with the application of the handle to the body portion.

962,695. Oil-Burner. Roland C. Casad, Covina, Cal. An oil burner comprising a plate formed with two openings, a bent tubular member having one end communicating with one of said openings to receive air from beneath the plate and having the other end directed downwardly above the plate to form an air outlet, an oil supply pipe extending through the other of said openings in the plate, a head formed with an oil cup at the upper end of said oil supply



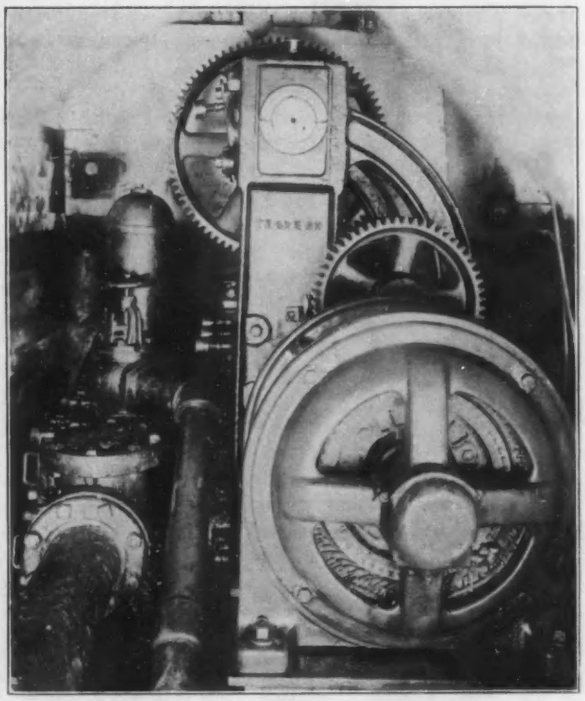
pipe and communicating therewith, said head extending within said air outlet and being of greater diameter than said oil supply pipe, and a second tubular member surrounding said oil supply pipe and extending beneath said oil cup, said second tubular member communicating with said other opening in the said plate to receive elastic fluid therethrough, whereby said elastic fluid is directed at the inside of the oil or vapor passing from the oil cup and the air from the aforesaid air outlet is directed at the outside of said vapor.

962,651. Sea Power-Generator. Robert Max Mobius, San Diego, Cal., assignor to F. K. De Borde, San Diego, Cal. A device of the character described, comprising a platform mounted upon piling, bearings on the platform, a pendulum frame swinging from said bearings, a vertically adjustable panel mounted in the frame, means for securing adjustment of the panel comprising a cable, a drum over which the cable passes, a crank for winding the drum and a pawl engaging the shaft of the drum, and chains in combination with sprocket wheels and pulleys.

INDUSTRIAL

REMARKABLE PERFORMANCE OF INDUCTION MOTOR.

A 20-hp., 3-phase, 220-volt standard induction motor made by the General Electric Company recently demonstrated the ability of the standard motors manufactured by this company to operate successfully under the trying conditions met with in mines where the air is very damp, without their being totally inclosed. This is of great importance, as thorough ventilation of the motor is absolutely necessary due to the high temperatures which prevail in mines. This motor is geared to a mine pump, located at the bottom of the shaft at the mines of the Richmond Iron Works, Richmond Furnace, Mass., and is installed in a chamber where the air is always very damp and moisture is continually dripping from



Standard General Electric Three-Phase Induction Motor Driving a Pump in Mines at Richmond Furnace, Massachusetts.

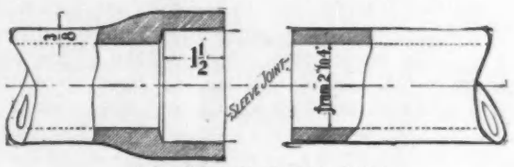
the roof timbers. It is protected from this water by a piece of tarred paper tacked above it, so as to conduct the water away.

During a heavy thaw last January, the surface water broke in on one of the upper levels and flooded the mine. The water rose so rapidly that the electric pump was soon under water, the top of the motor being two feet below the surface. Under such circumstances it was imperative that the pump should continue in operation as long as possible, and so it was not shut down. It continued to operate perfectly and at the end of two hours, during the whole of which time the motor was submerged under water, it had pumped itself clear of water. It was then stopped only long enought to clean the dirt and chips from around the rotor and put oil in the bearings, and then was started up again. This pump has been running about 20 hours a day ever since and the motor has apparently suffered no injury from its unusual experience.

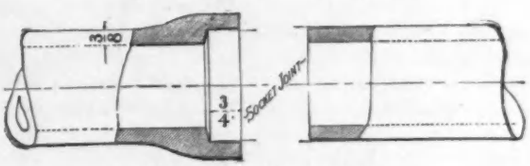
A NEW CONDUIT FOR UNDERGROUND CABLES.

A new cable conduit recently placed on the market by the H. W. Johns-Manville Co., New York, known as J-M Fibre Conduit, is especially noteworthy because of some features new in the manufacture of conduit. This conduit is made of indurated fibre, a material which has been used very extensively for insulating purposes, such as third-rail coverings, controller linings, battery boxes, etc.; water pails, etc., have also been made of it for many years.

In making J-M Fibre conduit, the fibre is moulded into shape under high temperature and immense pressure, and is entirely without grain or laminations. This process gives each length of conduit a solid 3/8-in. one-piece wall-homogeneous—with tensile strength that is remarkable when compared with the light weight of the conduit.



J-M Conduit Socket Joint.

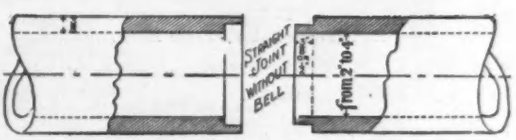


J-M Conduit Sleeve Joint.

But the most interesting feature of this new conduit lies in the bell joints shown above. One end of each section is moulded to an enlarged size—belled out—with an opening as large as the outside diameter of the opposite end of the next section. Thus, any two sections fit together without any reduction in the wall thickness of either section at the joint. This makes a stronger and more rigid connection than is possible with any other kind of joint.

In laminated fibre conduit, half the wall thickness at the ends of each length must be cut away in order that one length may fit or screw into the other. And that reduces the strength of the joint by half.

Realizing, however, that installation methods on some systems have been devised which necessitate the use of straight joints, the manufacturers have also arranged to make this new conduit with straight line joints, as shown below.



J-M Conduit Straight Joint.

The joints in this new conduit are perfectly smooth inside—they are machine moulded—perfectly true—no offset. And each length of the conduit is also smooth throughout its bore. This greatly facilitates the work of inserting cables.

The manufacturers claim that by reason of there being no seams or roughness at the joints of this conduit and as the air-tight joints prevent particles of concrete from seeping through, a No. 6 wire can be pushed through each duct from manhole to manhole, doing away with the ropes and rods so necessary with ordinary conduits.

Moreover, the smooth, tight joints and the smooth bore of this conduit should add greatly to the life of cable for the seams or raw edges at joints, burns, blisters, lumps, etc., are ordinarily the greatest cause of cable trouble as they injure or abrade the lead casing of cable when it is being drawn through the duct.

Tests made of this conduit with ⅜-in. thickness of wall show that it has an average puncture voltage of 40,800 dry and 33,000 volts after 40 hours immersion in water. Danger of electrolysis should therefore be practically eliminated by the use of this conduit.

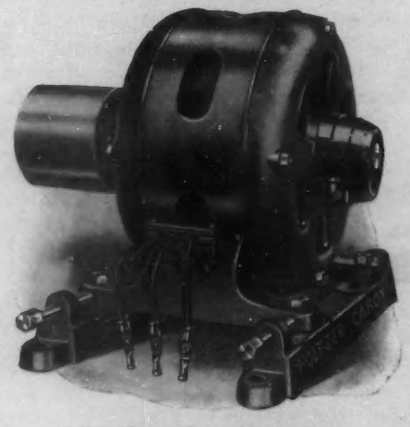
In weight, this conduit has an advantage over those made of stoneware, etc., as it weighs only about one-sixth as much. This makes it easier to handle. The light weight also cuts down the freight charges, which is especially noticeable when laying at a considerable distance from the railroad unloading point or from storage point. Breakage is also reduced to a minimum with this conduit by reason of the great tensile strength of its walls.

A variety of fittings such as bends, elbows, tees, etc., provide for bends and curves in the trenches. Two, three and four way junction boxes provide for branch and service connections. An attractive booklet has been gotten out by the manufacturers, and a copy can, no doubt, be obtained by writing to the H. W. Johns-Manvile Co., New York.

HOLTZER-CABOT POLYPHASE MOTORS.

In putting upon the market a line of polyphase induction motors, The Holtzer-Cabot Electric Co. does not in any sense pass through an experimental period, since its long experience in the more difficult design of single phase motors has enabled it to produce a particularly efficient line of polyphase motors.

These motors have been generously designed in all points where generosity counts. Their overload capacity, starting torque, heating, bearings, etc., are more liberal than



10 H.P. Holtzer-Cabot 3-Phase Motor.

is indicated by ordinary practice. They have been designed to start and carry heavy overloads, but at the same time good efficiencies and power factors have been reached. Close attention to details has produced machines having to a large extent all these desirable features.

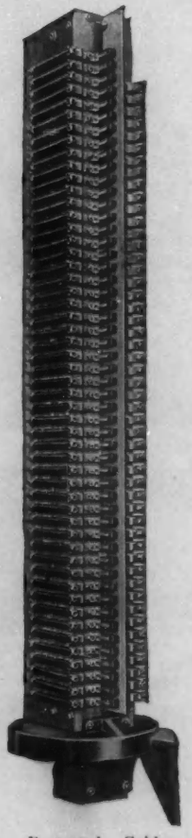
It has been recognized, however, that mere size and weight do not make good motors. Accordingly particular attention has been given to produce rugged and highly efficient motors of moderate overall dimensions. This enables them to be successfully used in many places where space is limited.

In mechanical construction these motors follow the conventional design which world-wide experience has proven best suited to polyphase apparatus. Particular attention has been given to producing good ventilation, and therefore cool running, by the use of revolving vanes. High power factor and good starting performance is assisted by the use of partially closed slots in all sizes; the slot opening being left large enough, however, to permit the easy removal of coils in case of trouble.

These motors are built for constant speed in sizes from one-half to 30 horsepower, and for all commercial voltages, frequencies and speeds. Compensator starters are ordinarily furnished with the larger sizes; although where the starting torque required is not great, primary resistance starters may be used, thus somewhat reducing the cost of the apparatus.

NEW PROTECTED TERMINAL CABLE.

A new cable terminal which has recently been placed on the market is designed to replace two of the older types of cable terminals, namely: the compact, hooded, but unprotected type, and the cumbersome wooden-box protected



Protected Cable Terminal with Cover Removed.

No. 18 Cable Terminal with Cover Partly Removed for Inspection of Fuses.

terminal. This new terminal, the Western Electric Company's No. 18, combines all of the advantageous features of design of those two older types. It is a compact, weatherproof device which affords protection to the central office equipment against lightning discharges and accidental contact with power wires.

The No. 18 protected cable terminal consists essentially of a rectangular oiled and shellaced wooden box into which the cable is led. Two sides of this box serve as mountings for the fuse clips and as fanning strips for the bridle wires. The third side acts as a support for cut-outs. During manu-

facture the interior of the box is filled with water-proof pot head compound, which fills all spaces between the fanned-out wires and seals the end of the cable against moisture. The box is mounted on a cast iron base, or bracket, in the center of which is fitted a wooden bushing for clamping the cable in place and relieving the wires of all strain.

The cable chamber, binding posts and connections are protected against weather by a heavy reinforced, galvanized sheet-iron hood which may be lifted to any height necessary to examine the fuses, etc. The hood is held at the desired height by a spring latch mounted on top of the fanning strips. However, should the hood be removed completely it will be prevented from falling to the ground by a non-corrosive sash-chain which attaches it to the bracket.

The protective devices supplied consist of fuses and open-space, carbon-block, cut-outs, two of each wired into each pair of wires, the cut-outs being connected between the fuses and the cable.

The Western Electric Company manufactures this type of protected terminal for use with No. 22 gauge wire, paper insulated, lead-covered cable in capacities of from 10 to 60 pairs of wires.

Ordinarily the terminal is supplied with a six-foot cable stub which is spliced to a cable of sufficient length to make the connection desired. However, where possible the terminal should be ordered with a cable of the required length, thereby eliminating one splice.

ELECTRIC VEHICLE PUBLICITY.

The Electric Storage Battery Company of Philadelphia has successfully launched one of the most comprehensive advertising campaigns ever undertaken to popularize the electric vehicle. The two directly interested parties in this publicity scheme—the central station managers and the electric vehicle manufacturers—have been shown the enormous advantage which would result in joining hands with the battery company to advertise on a very large scale the superior merits of the electric vehicle.

They have cordially endorsed the plan and the funds which they have contributed are to be expended in larger advertisements in magazines of national circulation—the intention being to lay before the public in an educational and graphic manner every week the real supremacy of the electric as a city and suburban pleasure and commercial vehicle.

The electric vehicle manufacturers have been large advertisers of their own product but this publicity is to be impersonal and one which means increased business to all parties concerned; The Central Station people are alive to the fact that it brings a permanent source of revenue to them. The work of laying out this campaign is being done by The Electric Storage Battery Co. That it has successfully wrought out this comprehensive and well thought out scheme is a matter of congratulation to all who have taken part.

NEW CATALOGUES.

Catalogue No. 8 from the Ohio Brass Company, Mansfield, Ohio, comprises an exhaustive compilation of standard types, forms and sizes of materials for electric railways, mine haulage systems and transmission lines.

Bulletin No. 4739, issued by the General Electric Company, describes the GE MAZDA incandescent lamp which has an improved tungsten filament and gives the high efficiency of 1 to 1¼ watts per candle. The bulletin describes this lamp in great detail, and illustrates the various sizes of this type of lamp for use on multiple circuits. It contains tables showing cost of operation and life, effect of voltage variation on candle-power and watts, relative costs of lighting with various lamps for equal illumination, etc., etc. It also devotes considerable space to the reflectors necessary to give the best results.

APPROVED ELECTRICAL DEVICES

RECEPTACLES, FOR ATTACHMENT PLUGS.

Surface Receptacles, Cat. Nos. 5617-5620 incl., 10 A., 250 V., with plugs 5419-5421 incl. Cat. Nos. 5621-5623 incl., with plug 5553, 20 A. 250 V. Flush Receptacles, Cat. No. 5547 with plugs 5419-5421 incl., and Cat. No. 5566 with plug 5567, 10 A. 250 V., Cat. No. 5552 20 A. 250 V., with plug 5553, 20 A. 250 V. Conduit Box Receptacles, Cat. Nos. 5614 and 5624, 10 A. 250 V., with plugs 5419-5421 incl. Approved March 4, 1910. Manufactured by

Hubbell, Harvey, Inc., Bridgeport, Conn.

RECEPTACLES, STANDARD.

"Bryant 3 A. 250 V." Sign, Cat. Nos. 1700, 40488, 46749 and 59108. Also "Ruby" 102717 when installed so that both the porcelain base and the metal rings are held by means of solder so that they cannot turn in the sign face. Cleat, Cat. Nos. 9402, 9403, 921, 1011, 1123, 50715, 11221, 28795, 54949 (formerly 23209), 58300 and 58301 (formerly 23210). Concealed, Cat. Nos. 50744; also 9447, fusible 2 A. 125 V. Moulding, Cat. Nos. 42453, 58302 and 58950 (formerly 34152). Conduit Box, Cat. Nos. 9514, 9397, 40507, 40537, 59107, 62357, 62355 and 62356. Approved Feb. 28, 1910. Manufactured by

The Bryant Electric Company, Bridgeport, Conn.

"T. E. M. Co." 3 A. 250 V. Conduit Box Receptacle, Cat. No. 976. Approved Feb. 9, 1910. Manufactured by

Trumbull Electric Mfg. Co., Plainville, Conn.

"C. S. K." 3 A., 250 V. Conduit Box Receptacle H. S. No. 3. Approved March 15, 1910. Manufactured by

C. S. Knowles, 7 Arch St., Boston, Mass.

RHEOSTATS.

Motor starting rheostats described in Bulletins 11B, 11C, 11D, and 12B ⅛-30 H. P. 125 and 240 V.; ⅛ to 50 H. P., 500 V. Approved March 15, 1910. Manufactured by

Union Electric Mfg. Co., Milwaukee, Wis.

SWITCH BOXES.

"Fancleve" cast iron switch boxes. For metal conduit, Cat. Nos. 351, 501. For flexible tubing, Cat. No. 651. For wooden moulding, Cat. No. 201 (Universal switch or junction box) and Cat. No. 402 (supporting box for surface snap switches). Approved March 4, 1910. Manufactured by

Fancleve Specialty Co., Jamaica Plain Station, Boston, Mass.

SWITCHES, COMBINATION CUTOUT.

Porcelain base switches with Edison plug cutouts, Cat. Nos. 701, 703, 721, 723 and 727 30 A., 125 V. Panel cutouts, Cat. Nos 714 to 719 inclusive, 15 A., 125 V. Porcelain base switches with cartridge fuse cutout, Cat. Nos. 704, 705, 724 and 725, 30 A., 250 V. Approved Feb. 28, 1910. Manufactured by

Trumbull Electric Mfg. Co., Plainville, Conn.

SWITCHES, KNIFE.

Type A, 250 and 500 V., all capacities, with or without N. E. Code standard cartridge enclosed fuse extensions. Type C, 0-300 A., 250 V., with or without N. E. Code standard cartridge enclosed fuse extensions. Approved March 9, 1910. Manufactured by

Agutter-Griswold Co., 411 Occidental Ave., Seattle, Wash.

SWITCHES, SURFACE SNAP.

"Perkins" 600 Volt Switches, single pole, 5 and 10 amperes. Approved Feb. 16, 1910. Manufactured by

Perkins Electric Switch Mfg. Co., Bridgeport, Conn.

C. E. M. Co., 3 A., 250 V. Conduit Box, Cat. No. 1225. Cleat, Cat. No. 9402. Sign, Cat. Nos. 1700 and 977. Approved March 1, 1910. Manufactured by

Connecticut Electric Mfg. Co., Bantam Connecticut.

NEWS NOTES

INCORPORATIONS.

HAVRE, MONT.—The Havre Electric Steam Heat & Telephone Company has been incorporated for $200,000 by C. C. Swinbourne.

VANCOUVER, B. C.—The Vancouver, Camas and Washougal Traction Company has been incorporated by H. C. Phillips with a capital stock of $100,000.

SAN FRANCISCO, CAL.—The Sunset Power Company has been incorporated by C. B. Greeley, W. L. Boos and Thos. Turner with a capital stock of $500,000.

ELLENSBURG, WASH.—The Electric Power Company has been incorporated by J. C. Donnelly and H. J. Manny of Tacoma, with a capital stock of $1,000,000.

EUREKA, CAL.—The Del Norte People's Telephone Company has been incorporated by one hundred and twenty-five merchants of Humboldt county, with a capital stock of $10,000.

SAN FRANCISCO, CAL.—The Bay Cities Home Telephone Company has been incorporated by James Lanagan, Guy Knupp, H. T. Bailey, C. F. Moeler and others with a capital stock of $20,000,000.

BELEN, N. M.—The Belen Light & Power Company has been incorporated by W. M. Berger, Oscar Goebel and Mary E. Berger of New Mexico and Chas. Henry Schull of Los Angeles with a capital stock of $25,000.

FINANCIAL.

ROSEVILLE, CAL.—At the special election held here the people approved the issue of $90,000 bonds for the installation of a sewer system and an electric light and power plant.

ASHLAND, ORE.—Ashland voted $55,000 improvement bonds at a special election; of this $25,000 is to complete the municipal electric light and $30,000 for paving street intersections.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Power Company, which is supplying power for the operation of the United Railroads in this city, has authorized the issuance of $6,500,000 of first-mortgage 5-per-cent bonds for the purpose of enlarging its plant and so extending its facilities that it may be enabled to supply intending purchasers with all the power required.

SAN FRANCISCO, CAL.—The Supreme Court has handed down a decision in the Geary street bonds case, in which every point made by the city is sustained, and the way is paved for the sale of the bonds. The decision declares that the course of the city officials in the matter has been regular and construes the city charter and the State Constitution in such a way that no question is left as to the city's right to construct, complete or purchase a municipal street railway system.

TRANSMISSION.

SAN FRANCISCO, CAL.—The Mariposa Electric Power Company has filed application in the Superior Court for voluntary dissolution.

HAMILTON, MONT.—S. R. Inch of the Missoula Light & Power Company, has been granted permission to construct a high power tension transmission line along the public roads of the valley.

LA BARRANCA, SONORA.—The Sunset Mining Company, a subsidiary of the Southern Pacific is now drawing up plans to put in a large power plant and sell power to surrounding mines and hamlets.

SANTA ROSA, CAL.—Manager Thomas D. Petch of the Santa Rosa Branch of the Pacific Gas and Electric Company, has received orders for the construction work involving the laying of 12 miles of new 2-inch gas pipe, and two miles of ¾-inch pipe. The new work will be begun as soon as the material can be secured.

CLARKSTON, WASH.—The Grande Ronde Water & Power Company of this place, recently organized with a capital of $1,000,000, has started on the survey for its proposed power plant on the upper Grand Ronde river. The river at the point or site of the plant is capable of producing 30,000 horsepower.

KLAMATH FALLS, ORE.—J. Lewis and G. McDonald arrived in this city from Lakeview where they have looked after the development of a new power plant for which they have the rights on Deep creek, about 22 miles east of Lakeview. It is estimated that 7000 horsepower can be developed. Work is to commence this summer.

LAS VEGAS, NEW MEX.—Incidental to taking over the Las Vegas Light & Power Company, and Las Vegas Transit Company by the Federal Light & Traction Company of New York, a corporation which is being formed for control of numerous light and power companies in Colorado, New Mexico, Arizona and Wyoming, it is said that two local companies will be extended and enlarged. Their line will also be extended to Hot Springs.

EL PASO, TEX.—The El Paso Electric Railway Company has filed a certificate of increase whereby the capital stock of the company is increased from $1,500,000 to $2,500,000. Some of the improvements to be taken care of by the addition of one million dollars to the operating capital of the company is the extension of the smelter line to the cement plant and the enlargement of the power plant to more than double its present capacity and the purchase of new cars.

REDDING, CAL.—The Sierra Nevada Power & Irrigation Company has filed three complaints in the Superior Court of Shasta County against the Central Pacific R. R. Co. and others, to condemn rights of way for a ditch and power line, and to quiet title to riparian rights of landowners on Montgomery Creek, Hatchet Creek and Roaring Creek. The irrigation company was incorporated April 19, and to purchase it has acquired water rights for a total of 15,000 inches, 5000 inches on each side of the three creeks mentioned. The three creeks run into Pit river where the company proposes to construct its power-house. In order to bring the water of the three creeks together at the power-house the company must have rights of way for its flumes and ditches. The question of condemning riparian rights is involved in the actions.

OROVILLE, CAL.—Charles Swezy, an attorney of Sacramento, has filed an appropriation of 20,000 inches of water. Of this amount of water 10,000 inches are taken from the water of Mosquito Creek and 10,000 inches of the water of French Creek. The filing was made in the name of Annie Swezy. The purpose of the appropriation are named as irrigation and power. The water will be taken from Mosquito Creek at a point one mile from its junction with French Creek. The water of French Creek is located at a point

above the junction of the two streams. The notice states that the water of Mosquito Creek will be diverted by means of a dam 15 feet high made of concrete and 40 feet wide. On French Creek it is proposed to build a dam ten feet high and 50 feet wide. The water will be carried in ditches 12 feet wide at the base to the power house. The appropriations do not state the location of the power house. From the locations stated, however, it is presumed that the power house will be west of the Berry Creek Hotel.

ILLUMINATION.

SAN BERNARDINO, CAL.—Plans are being drawn for an electric light plant to be installed by the Barstow Utility Company.

OAKLAND, CAL.—The building committee of the Supervisors has been authorized to install a permanent electric and power plant in the new county jail.

KLAMATH FALLS, ORE.—Frank Smith has made application tc the Council for a franchise for the installation of a gas plant. He proposes to manufacture the gas out of the garbage of the city.

OAKLAND, CAL.—On the recommendation of City Electrician Babcock it has been ordered that hereafter the tungsten lamps shall be installed and the arc lights gradually eliminated.

FRESNO, CAL.—With the completion of the two freight sheds for the Southern Pacific by August 1, it is reported that the men there will soon after be engaged in erecting a private power plant near the round house for supplying the depot and yards with electric current for illumination.

CENTRALIA, WASH.—The Twin City Light & Traction Company has let the contract for a $150,000 power plant to be located at Coal Creek, about four miles southeast of Centralia, the plant to furnish power for the electric cars besides all the power needed for the lighting and commercial purposes of Centralia and Chehalis. The plant is to be completed in about three months.

DUNSMUIR, CAL.—The Siskiyou Electric Light & Power Company has acquired all the electrical holdings of the Mossbrae Falls Light & Power Company, and hereafter will be the sole occupant of this field. The purchase was effected on Jnue 15th. The Mossbrae power plant will be abandoned, the new company having abundant power of its own, and the poles and wire of the old company will be taken down.

SAN FRANCISCO, CAL.—The Commissioners have awarded to the Mutual Electric Light Company the contract for furnishing current for light, power and other purposes in the Ferry depot and along the waterfront for the next three years. The Mutual company's bid was $1.25 per week for each arc light of 2000 candle power and a rate of .0275 per 1000 watt hours for electric current for other lights, power and other purposes.

LOS ANGELES, CAL.—The plant of the West Side Electric Company at Maricopa will be enlarged greatly and power and lights will be furnished in adjacent oil fields, Taft and Moron as well as Maricopa. H. C. Shippee, president and general manager of the company, which has offices in H. W. Hellman Building, has just returned from an extended trip to the East, where he has arranged to finance the proposed extension of the company's plant.

PENDLETON, ORE.—The Pacific Power & Light Company, with a capital stock of $7,500,000, has been formed. The work of organization was done by the American Power & Light Company of New York, which already owns the Portland Gas & Coke Company. F. Sykes and S. Z. Mitchell, former Portland residents are respectively president and chairman of the board of directors, and G. Talbot of Portland is the vice-president of the American Power & Light Company. The officers of the Pacific Company are not yet announced. The new concern plans a system of power development in the Pacific Northwest and will cover the Columbia, Yakima, and Walla Walla Valleys with its transmission lines and distributing system.

TRANSPORTATION.

OREGON CITY, ORE.—The Portland Railway, Light & Power Company will build a branch from West Oregon City to Oswego.

GLENDALE, CAL.—An electric street railway franchise on Glendale avenue north of Third street has been awarded by the City Trustees to E. D. Goode.

POMONA, CAL.—The City Council has passed an ordinance granting to G. E. Pillsbury a franchise to construct and for a period of 50 years to maintain and operate an electric railway in the public streets of Pomona.

OAKLAND, CAL.—The San Francisco, Oakland and San Jose Railway Company has contracted with a general railway signal concern of Rochester, N. Y., for the installation of a complete signal system at its terminals.

VENICE, CAL.—It is announced that President Gilliis of the Los Angeles-Pacific has obtained from New York full authority to go ahead with the proposed four-tracking of the line between Venice and Redondo.

REDLANDS, CAL.—General Manager Merrihew has announced that he is to go to Redlands to represent the San Bernardino Valley Traction Company in a conference over a petition for an extension of an electric line to the University of Redlands campus.

SANTA MONICA, CAL.—Early next month the new management of the Los Angeles-Pacific Railway Company will begin the improvement of the entire system. Five hundred men are to be put to work reballasting the lines with crushed rock. All light rails are to be replaced by heavier steel and new and heavier switches are to be put in.

SAN RAFAEL, CAL.—In executive session the town trustees instructed County Surveyor George L. Richardson to visit San Francisco and gather data on its street railway system for the purpose of making a report at the next regular meeting in connection with the petition of W. L. Courtright for a franchise to operate an electric road in the town limits. This is regarded as the first definite move toward the construction of a street railway. Courtright's plan is the prelude to a campaign which has been launched by capitalists and businessmen of Novato, San Rafael, San Anselmo, Kentfield, Larkspur, Ross and Corte Madera to raise $125,000 to begin building a street railway from Novato through San Rafael and Ross Valley towns to Corte Madera. It is estimated that $65,000 must be raised to float bonds for the proposed road.

OAKLAND, CAL.—The Peninsula Railroad Company, an allied corporation of the S. P., which was recently granted a street railway franchise by the City Council, has done its first work under that instrument on Twentieth street. This was done upon the request of the city street department in order that the new asphalt pavement, which is being laid on upper Broadway, may be put down permanently. The railroad is installing a crossing over the lines of the Oakland Traction Company. The rails are being laid from Twentieth street across Broadway and will be extended east and west when the installation of the line is completed. Under its franchise, the Peninsula Railway Company proposes to operate an electric line over a loop running from the Fourteenth and Franklin street depot to the Sixteenth street depot of the Southern Pacific.

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HANFORD, CAL.—At the organization meeting of the Hanford and Summit Lake Railway Company, held in Hanford the following officers were elected: Chas. King, Hardford, president; Ralph W. Heins, vice-president, Santa Cruz; J. O. Hickman, Hanford, treasurer; Clifford McLellan, San Francisco, general counsel; John B. Rogers, San Francisco, general manager and chief engineer. C. E. Lilley, Santa Cruz, general land agent. The directors of the company authorized an issue of $500,000 of five per cent, 30-year gold coupon bonds, interest payable semi-annually, of which $300,000 will be offered for general subscription to the public. These bonds will be secured by first mortgage on all the road and personal property of the corporation. The Old Bank was designed as the trustee for the purpose of carrying out the conditions of the deed of trust. The company will begin immediately the acquisition of the rights of way and will begin construction at the earliest possible date.

MARTINEZ, CAL.—An application for a franchise has been made by A. W. Maltby of the Oakland-Antioch Railway was discussed. Work on a part of the line over a private right of way has already been commenced near Walnut Creek. According to the engineers of the company the proposed road is to extend from Oakland to Martinez, passing through the inter-county tunnel and through Lafayette, Walnut Creek and Concord, a distance of 20 miles. It is proposed to operate the road by electricity and the Board of Supervisors of Alameda county has already granted the road a permit to use the tunnel upon the fulfillment of certain provisions. They relate to the lighting of the tunnel and to the safety of teams and pedestrians using the road through it. In discussing the building of the road, Maltby says that it means the greater development of the interior county, which is now reached only by wagon roads. The county is rapidly being developed, and it is the intention of the road to do a general freight and passenger traffic. The project is receiving the support of the commercial bodies of Contra Costa county, as it is proposed to run a line to Bay Point where the company has secured water front rights.

WATERWORKS.

CONDON, ORE.—A contract for putting in the meters for the city has been awarded by the Council to Jamison & Marshall.

COTTAGE GROVE, ORE.—The City Council has entered into a contract with the American Light & Water Company to construct a complete water system and pipe line from Laying Creek to this city.

SAN FRANCISCO, CAL.—The annual suit against the supervisors to prevent the enforcement of the rates established by them have been filed by the Spring Valley Water Company in the U. S. Circuit Court. The water company has been granted a temporary restraining order.

TURLOCK, CAL.—The Board of Trustees have passed an ordinance determining that the public interest and necessity demand the construction and completion of a more extensive water system for the purpose of providing additional facilities and means for furnishing water to the inhabitants of the City of Turlock.

HOLLISTER, CAL.—The San Benito Land & Water Company is surveying a site for a reservoir which is to be located about a half mile from Paicines. The reservoir is to cover an area of 160 acres and will have a capacity of 4000 acre feet. The water is to be taken from the Tres Pinos and San Benito rivers. The ditch, on which work has been commenced, is to connect with the present ditch which conducted water from the San Benito river about six miles south of Hollister. In order to connect the new reservoir with this old ditch about six miles of new ditch will have to be constructed.

ROSEBURG, ORE.—The Council has granted to the Douglas and Coos Power Company a fifty-year franchise to operate a water and light and power system in this city, work on which is to commence in two months after the granting of the franchise. The company is composed of C. Bell, F. Blakeley, F. Waito and W. Cardwell.

SAN JOSE, CAL.—A communication has been received from the San Jose Water Company stating its desire to erect a trestle across the Coyote creek to carry a six-inch water main from Fourteenth street, between San Antonio & San Carlos streets, to a main already laid in Franklin street, East San Jose, to provide an additional water supply for that town. The matter was referred to the River Improvement Committee.

SALINAS, CAL.—Certified copies of the amended articles of incorporation of the Soledad Land and Water Company and of the certificate of proceedings of the company have been filed with County Clerk T. P. Joy. The corporation has recently decided to diminish its capital stock from $30,000, divided into 1000 shares of $30 each to $18,600, divided into 620 shares of $30 each. The action was taken at a meeting of the directors and stockholders held in this city on May 28 last. The principal place of business of the corporation has been changed from Hollister to Salinas, and the company now operates a pumping plant as a private corporation, and not a public water service. The concern was organized within the past year, the five directors originally elected being N. C. Briggs of Hollister, B. F. Gould of Soledad; H. H. Tracey of San Francisco; H. N. Tracey of Hollister and Thomas Flint Jr. of San Juan.

OAKLAND, CAL.—The water-rate resolution establishing a 5-per-cent cut over the rates of last year went into effect yesterday without any contest on the part of the People's Water Company. The new rate will extend through the fiscal year 1910-11, and, although the water company hoped that the previous rate would prevail in the interest of much improvement work which is being planned. President F. A. Leach of the company says: "There will be no contest of the rates fixed by the City Council. The Council saw fit to reduce the rates according to the provisions of the agreement secured four years ago between the city and the water company. We, as a part of the agreement are ready to stand upon its terms. The company will take care of the future. We are working on plans for the development of the San Pablo dam and water sources. Whether we will carry out these plans or decide upon some other source has not been decided, but at present we are giving the San Pablo section the most serious consideration."

SAN FRANCISCO, CAL.—The Supervisors have passed to print a bill fixing the same water rates for the householder and the city for the ensuing fiscal year as were provided for the fiscal year nearing a close and reducing the toll to the shipping interests more than one-half. Under the new ordinance the shipowners who have been compelled to pay 75c for 1000 gallons of water will now have to pay about 32c. The scale under the new law is graduated, but in no case will it be over 66c, where before it was $1.50. Officers of the company say that the cut in favor of the shipping men will cost the corporation $50,000 a year and Supervisor Nelson, chairman of the water-rates committee, thinks that this amount will be increased to $70,000. According to the statement of representatives of the company application will be made for an injunction to prevent the enforcement of the new bill. This has been the proceeding heretofore and the excess demanded by the company has been placed in escrow by the Federal Court until such time as the questions involved have been determined.

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Mansfield, Ohio.
San Francisco, Monadnock Bldg.
Los Angeles, Pac. Electric Bldg.
Seattle, Colman Bldg.

Okonite Co. 1
New York, 253 Broadway.

P

Pacific Electric & Mfg. Co. 9
San Francisco, 80 Tehama.

Pacific Gas & Elect. Co., The 13
San Francisco.

Pacific Meter Co. 1
San Francisco, 311 Santa Marina Bldg.

Pacific Tel. & Tel. Co., The
San Francisco.

Partrick Carter & Wilkins Co.
Philadelphia, 22d and Wood

Pelton Water Wheel Co., The 9
San Francisco, 1095 Monadnock Bldg.

Phillips Insulated Wire Co. 1
Pawtucket, R. I.

Pierson, Roeding & Co. 4
San Francisco, Monadnock Bldg.
Los Angeles, Pac. Electric Bldg.
Seattle, Colman Bldg.

Portland Wood Pipe Co. 9
Portland, Ore.

R

Reisinger, Hugo 11
New York, 11 Broadway.

S

Schaw-Batcher Co. Pipe Works
Sacramento, Cal., 211 J St.
San Francisco, 356 Market.

Simplex Elect'l Co., The 3
Boston, 110 State.
San Francisco, 612 Howard.
Los Angeles, Security Bldg.
Seattle, Alaska Bldg.
Portland, Couch Bldg.

Simplex Electric Heating Co.
Cambridge, Mass.
San Francisco, 612 Howard.
Los Angeles, Security Bldg.
Seattle, Alaska Bldg.
Portland, Couch Bldg.

Southern Pacific Co. 14
San Francisco, Flood Bldg.

Sprague Electric Co. 13
New York City, 527-531 W. 34th.
San Francisco, Atlas Bldg.
Seattle, Colman Bldg.

Standard Und. Cable Co. 1
San Francisco, First National Bank Bldg.
Los Angeles, Union Trust Bldg.
Seattle Office, Lowman Bldg.

Star Expansion Bolt Co.
New York City, 147-149 Cedar.

Sterling Paint Company, 11
San Francisco, 118 First.

Swayne, R. B. 9
San Francisco, 813 Postal Telegraph Bldg.

T

Technical Book Shop 12
San Francisco, 604 Mission.

Tel. & Elec. Equip. Co. 3
San Francisco, 612 Howard.
Los Angeles, Security Bdg.
Seattle, Alaska Bldg.
Portland, Couch Bldg.

Thomas and Sons Co., R.
New York, 227 Fulton.
East Liverpool, Ohio.

Tracy Engineering Co. 9
San Francisco, 461 Market.
Los Angeles, Central Bldg.

V

Vulcan Iron Works 1
San Francisco, 604 Mission.

W

Western Electric Co. 4
San Francisco, 680 Folsom.
Oakland, 507 16th.
Los Angeles, 119 E. 7th
Seattle, 1518 First Ave. So.

Western Wireless Equipment Co. 9
San Francisco, Grant Bldg, 7th and Market.

Westinghouse. Elec. & Mfg. Co. 6
Pittsburg, Pa.
Los Angeles, 527 So. Main.
Denver, 429 17th.
Seattle, Central Bldg.
Salt Lake City, 212-214 So. W. Temple.
San Francisco, 165 2d.
Spokane, Columbia Bldg.
Portland, Couch Bldg.
Butte, Lewisohn Bldg.
Canada, Canadian-Westinghouse Co., Ltd., Hamilton, Ontario.
Mexico, G. & O., Braniff & Co., City of Mexico.

Westinghouse Machine Co. 6
Pittsburg, Pa.
San Francisco, 141 Second.

Weston Elect'l. Instrument Co. 14
Waverly Park, N. J.
New York, 114 Liberty.
San Francisco, 682-684 Mission.

Wilbur, G. A. 9
San Francisco, 61 Second.